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JAN. 10, 1955

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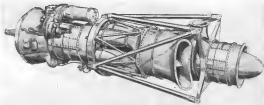
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Napier Unveils Turbine for Fairey Compound Copter

To meet requirements of the upcoming Fairey Rotondine 40-passenger compound helicopter, G. Napier & Son has developed this version of its third helicopter engine to serve both vertical and helicopter forward flight needs. This model currently is rated at 3,000 shp. It features an auxiliary compressor (on right) mounted coaxially to the rear of the engine supported by the turbine structure which also acts as the casing for the main engine. A

flexible coupling, between the turbine and the turbine compressor, permits power to be taken through the propeller for its main flight, or from the auxiliary compressor in the form of compressed air to the main rotor motor. Thus, the shaft and loading, power from the auxiliary compressor would drive the main rotor for helicopter forward flight, the auxiliary compressor would be "disconnected" and the main engine would turn its propeller.

Domestic

Lockheed's XPV-1 VTO was selected to make its initial flight take off last week at Palmdale, Calif. XPV-1 was to arrive landing gear fixed for earlier horizontal take off, landing flights. Plans was to make first vertical flight somewhere, while Convair VTO, which initially took off in a hangar using perambulatory rollers, made five flights later.

Fairchild Helicopters Corp.'s first HUP-1, new version of the HUP-2 with a Wright R-1300 engine, has made its first flight. Company will modify a second helicopter for Navy tests.

Diana Buile, 32, will leave this week to make an unaccompanied attempt to fly around the world in 1955, she killed last week when her converted A-10 bomber crashed into the Gulf of California in a cargo flight from Long Beach. Early reports indicate she ran out of fuel. Mrs. Buile and her husband were operators of Buile Airborne Products.

An F-86B was certified as first operational transmitter, an electronic aid for determining reliability, at Andrews AFB, Md., headquarters of Military Air Transport Service. Approximately 70 other bases scheduled to receive the weather aid.

Fairchild Aircraft Division, Hagerstown, Md., delivered its 1,000th C-119 Flying Boxcar to USAF Dec. 22. Other aircraft industry milestones: McDonnell Aircraft Corp., St. Louis, Mo., delivered its 1,000th plane, an F-105D. Douglas set flight in the Navy as Dec. 28, and Piper Aircraft Corp., Lock Haven, Pa., delivered its 1,000th two-engine Apache business plane.

Jet thrust spoiler "brakes" have been designed for possible future application on Boeing B-47 Stratojet bombers by General Electric. Co's Aircraft Gas Turbine Division, Cincinnati. Ohio GE also has developed a thrust reverser, similar in principle to the spoiler, providing up to 15% reverse thrust on the J47-D jet engine rating.

Lockheed Aircraft Corp. has been awarded a \$58,685,973 Navy contract for a number of early warning Super Constellation radar pickets.

Utility and executive plane represents by seven manufacturers during November totaled 268, including 212 four-place or more, and 55 constant speed aircraft. Total dollar value \$3,717,800. Comparable shipments in October totaled 175 planes valued at \$3,603,000.

Mrs. Oscar A. Schlegel, 35, one of the first women aircraft mechanics and

among the few women to qualify as an Enly Enly died Dec. 29 at Downport, Iowa.

Western Air Lines has ordered five additional Douglas DC-6Bs, with delivery scheduled for 1956. Airlines expects that it will show substantially higher earnings over 1955's \$1,144,364.

USAF will spend \$54,625,325 to stockpile machine tools for the aircraft industry. Long leadtime items will be chosen with emphasis on tools that can be adapted to changing factory methods. An Air Force Contractual will negotiate contracts.

Financial

Northwest Direct Airlines predicts its revenues for 1955 will climb to an all time high of approximately \$70 million. Revenues for 1954 totaled a modest \$63,021,000, exceeding by more than \$1 million the previous year's \$61,731,000 net in 1953. Net operating income for the first 11 months of 1954 \$1,919,075, compared with \$1,349,294 for the same period of 1953.

International

Fokker Industriële Aeronautiek, S. A. has completed its first test run for the Brazilian air force at Gullens Airport, Rio de Janeiro.

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The Aviation Week
January 10, 1955

Heading Rows

ITALY to spend \$28 million for DC-10...	17
Army Aviation Buying Flight Lesson	18
Design Changes Make F-16 Supersonic	22
NM Rule: Jet Impulse Starting Test	23
MAWS in '54, 4000 Downer Tests	24
U.S. Now Already Exporting Support F-16	25
U.S. to Do Shock Research Later	26

Aggravated Engineering

Full-Service Market Research 19

Production

Restricted to Treasury Function Use 30

Appendix

Summary Statistics: Export Policy's Job 38

Aviation Safety

Part, Catalog, Not for Maintenance 78

Air Transport

Women's Health Policy, House, N.Y. House	41
Wounded Warriors Memorial Services	41
Gov. Roberto Arévalo's Visit	42
TWA Complaints Increasing	41
National Airport Has Biggest Loss	41
Seaboard Goes Atlantic Coast in '84	42
World Express Western Services	42
New Canadian Rule: Mile From Clouds	44
Passenger Supports National Airlines	44
Dallas Was Smoked in Airport	44

Departments

News Briefs	(11:00-11:30 a.m.)	1
Feature Page	(11:30 a.m.-12:00 p.m.)	2
Who's Who	(12:00 p.m.-12:30 p.m.)	3
Industry Observer	(12:30 p.m.-1:00 p.m.)	4
Submissions Deadline	(1:00 p.m.-1:30 p.m.)	5
Bar's	(1:30 p.m.-2:00 p.m.)	6
Trade & Tech	(2:00 p.m.-2:30 p.m.)	7
Press Release: Is Selling	(2:30 p.m.-3:00 p.m.)	8
Newly Constructed	(3:00 p.m.-3:30 p.m.)	9
USAF Contracts	(3:30 p.m.-4:00 p.m.)	10
LEAD Comments	(4:00 p.m.-4:30 p.m.)	11
Greening Construction	(4:30 p.m.-5:00 p.m.)	12
Greening Spotlight	(5:00 p.m.-5:30 p.m.)	13
New American Products	(5:30 p.m.-6:00 p.m.)	14
Also on the Market	(6:00 p.m.-6:30 p.m.)	15
Shortcuts	(6:30 p.m.-7:00 p.m.)	16
New Subdivisions	(7:00 p.m.-7:30 p.m.)	17
Specialty Calendar	(7:30 p.m.-8:00 p.m.)	18
Letters	(8:00 p.m.-8:30 p.m.)	19

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Page 19

Index 18, 19
11

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New Convair YF-102A Gets Supersonic Workout

LATEST VERSION of Convair Davison's delta-wing interceptor is the YF-102A, shown taking off from Edwards AFB, Calif., piloted by Richard Johnson. Numerous design changes, such as its new nose, revised cockpit canopy and addition of tail bladders to aid its supersonic performance in level flight are explained in an article with additional pictures on p. 22.



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WHO'S WHERE

In the Front Office

R. A. Stenches, Jr., is new president of Champion Spark Plug Co., Toledo, succeeding his father, **R. A. Stenches, Sr.**, who became chairman of the board. Other changes in the executive management: **F. D. Stenches**, co-chairman of the board, **Howard B. Speyer**, vice president-treasurer, **R. K. Chelton**, vice president-research and engineering, **G. C. Lighty**, vice president, **Henry Deitz**, equipment sales manager. New board member: **Dr. J. S. Owen**, general manager of the George Deane, outstanding aircraft new president **F. R. Biddle**, who has retired.

H. J. Schroeder, past president of the National Association of Boat Builders Officials, ended 12 years as Milwaukee state treasurer of associations last week to spend his time in recreational life in Milwaukee. He was succeeded by **Michael Finster**, Jr.

J. S. Fidler has been named general manager of General Electric Co.'s Aircraft Gas Turbine Division, Cincinnati, filling the vacancy created recently by appointment of vice president **G. W. Latham** as group executive of the company's Atomic Energy and Defense Products Group. Fidler previously was manager of the small aircraft engine department.

Herbert Knaul has moved up to executive vice president of Solar Aircraft Co., the first to hold that position since the late 1930s was founded in 1923.

Kenneth M. Patterson has been promoted by Avco, Inc., Woodbury, N. Y., to vice president-engineering and manufacturing. Also promoted to vice president: **William G. Buckles**, vice president Myco, Inc., Syracuse.

Frank C. Nash, senior assistant secretary of Defense, has been elevated to the board of General Dynamics Corp., New York. Other new director: **Robert B. Webb**, vice president-general counsel of the Air's Cannon Division; **Alvin D. Merfeld**, vice president-management and secretary of the corporation.

Honors and Elections

Dr. William R. Higgins, professor of electrical engineering at Iowa Institute of Aeronautics, has won the 1954 Distinguished Achievement Award of the American Society of Mechanical Engineers for his work in the development of the Air Force's first jet engine during his association with the Air Force's Wright-Patterson Research Center (1946-52).

Changes

Thomas R. Nelson is director of North-west General Aviation's new Air Freight Sales Division, and **Paul R. Evenden** has become director of the newly created Air Express Division.

R. H. Landberg has named up to General Vought Aircraft, Inc., Dallas, as chief technical engineer. Also promoted: **Charles H. Colburn**, to assistant chief of flight test.

Vernon A. Johnson has become Washington, D. C., manager for Lockheed Aircraft Corp.

(Continued on p. 57)

INDUSTRY OBSERVER

►Radically new picture tube, developed by Wills Motors' Electronics Division, which speeds the way to displaying color and broadens applications in explosive warheads, currently in color, is expected to be shown in the West Coast this week. Existence of the new tube was first revealed in Aviation Week Sept. 20, 1954, (p. 100). Tube was developed under the supervision of **William R. Allen** and will have many other military applications.

►Victory Supermarine Swift is still being evaluated for service by the Royal Air Force. Swifts were cleared for service early last year and one squadron received several Mk. 1 and Mk. 2 versions. The aircraft have been grounded since and no other versions have been used for squadron service.

►Reynolds F-84F Thunderstreaks in service have a Mach limitation of 1.175. Mach 3 to 4 is a permeable with external tanks. Ferry range is more than 2,800 mi.

►H. S. Navy is experimenting with a wingtip radar installation on a McDonnell F2H-3 Banshee. Scanner is mounted in a dipstick-type pod.

►Gruemmer is investigating the use of the Lear 5-in. gyro horizon in a replacement for the F-4s, model now used because of the excellent availability of the large instrument, an important factor in improved aircraft. McDonnell has acquired Lear gyro horizon for the F3H (Aviation Week Dec. 27, 1954, p. 38).

►Napier turbo-prop Kestrel engine has completed 150-hr. type test at its initial power rating of 3,000 shp. Company reports engine is on schedule and the 150-hr. test was completed satisfactorily on first attempt. Second test first test flown last August.

►Fairey Gannet anti-submarine aircraft has completed a comprehensive range of hot weather trials to test the aircraft's Double Mustang engine under full Mediterranean conditions. Service flying and delivery of spareparts production aircraft have been resumed following engine modifications. Flight was grounded early in October because of engine defect.

►Breguet 960 Vulture turbo-prop-jet prototype will have its 3,000-hp.-thrust test subjected to a modification program to make the plane a prototype for a new, lighter French supersonic plane, the Breguet 1050. Another Breguet 960 is being altered to include a boundary layer control system which will provide greater lift and lower landing speed.

►Mazda Daimatsu M.D. 410 Onagura jet fighter, fitted with a "Pulsar" landing gear and parachute, has successfully landed on an unprepared field in 318 ft., 1,845 ft., distances varying according to the plane's load. Takeoffs were made in 1,865 ft. to 2,125 ft.

►Mered Daimatsu M.D. 455 two-place night-fighter version of the Onagura has been modified as a flying incubator in order to carry out engine test experiments.

►Three French SIPA 183 light trainers, powered by Turbomeca Poles jets, have started their initial flight tests. One of the planes is scheduled to go to Argentina.

►Grumman F7F-3 soon will be equipped with angle of attack indicators on a production basis. Instruments are manufactured by Sperryco, Inc., Syosett, N. Y.

►Air Navigation Development Board is scheduled to meet this week to make a decision in the civil-aviation dispute over a "common system" of navigation involving the civil DME and military Tacan systems. ANDB will consider the recommendations that were made recently by its Vortec committee.

Pentagon and Congress

Joint Defense Department officials are following Pentagon lines in their own congressional investigations. Word has gone out to military spokesmen advising them that the Office of Assistant Defense Secretary (Legislative and Public Affairs) Eval A. Sargent must obtain information proposed for Congressional use. The pass for data submitted to House or Senate probes as well as the answers to queries from individual congressmen.

Award passage of the order is to insure that when information is provided, it is complete information, not confined to what one officer or one service knows about a particular subject. Often, and unaccounted, before Defense Department must spend several weeks on the service.

It is generally believed in Washington that the Democrats, now in the congressional driver's seat and a good position to influence the Administration, will show restraint. They are expected to run their ships carefully at top Administration officials, avoiding the lead pipe techniques that brought inquiries into some departments during the past two years.

Airline Mergers

Dispute over whether and to what extent Eastern Air Lines has control of Colonial Air Lines, which has been running over since the White House learned of a proposed Eastern-Colonial merger, at a top secret declassification. Hearings closed with failures that all but about 4,000 of the 110,024 shares originally bound to be under EAL influence have been disposed of.

The buy sale was 15,726 shares by Allen and Company last week, leaving Colonial stock less than 100,000 shares under terms of the latest Eastern offer of one EAL share for two Colonial shares. National offers to make a new offer after the control question is closed up.

Another source got a single board report from CAB ordered suspension and revocation of the route increase by Northeast Airlines. The Board officials that one of the increases was granted, they wouldn't take Northeast's financial problems, CAB says. "It would appear that any effective solution of the problem lies in the direction of pursuing sound merger possibilities or similar course of adjustments rather than by making its changes to the traveling public."

Manpower Investigation

White House denied that it has received a letter from Army Chief of Staff Gen. Matthew B. Ridgway regarding proposed Army personnel cuts is due to the fact that the paper is directed to Pentagon channels. Ridgway has written to the President, voicing his deep concern over proposed cuts in the ground force. The paper is being sent to President Eisenhower through Army Secretary Robert Stevens and Defense Secretary Charles E. Wilson.

News that it is generally accepted that the President made the decision himself, taking his action on what he considered to be sound information from military advisors. Ridgway's disagreement with his Commander-in-Chief, already in secret, may get a congressional airing. Sen. Robert F. Kennedy, now chairman of the Senate Armed Services Committee, has announced that his group

properly will hold closed door hearings on the planned Army cutbacks. House Armed Services Committee is expected to make a similar investigation.

Negotiation on Panama

Joint Defense Department's antitrust case against Pan American World Airways and W. R. Grace and Co., seeking to direct them from control of Panama, may be negotiated, pending the necessity for lengthy court litigation. PAW is voluntarily submitting records and data to the department.

Assistant Attorney General Stanley N. Beeson points to the average requirement of two and a half years for settlement, compared with five years for court cases. Referring to the former set, PAW declared Panama has been in integral part of its system for 25 years "with the full knowledge and approval of the government and to the great benefit of the public" (Aviation Week May 1, 1954, p. 76).

Air Force ROTC Plans

USAF is considering plans to open its pilot recruitment program and to place ROTC engineering graduates in attractive assignments.

College students at Air Force ROTC units may be given an opportunity to take flying lessons from private contract airlines which will lead to a private pilot's license. USAF believes this will increase the Nation's interest in flying and serve as a recruiting point for individuals who would wash out of regular Air Force flying training schools.

ROTC graduates with engineering degrees may be granted opportunities to serve three years with the National Aeronautics Administration where their skills can best be utilized. Air Force officials this will help alleviate the shortage of professional engineers for top priority NASA projects and give the young engineer valuable experience in future civilian work.

CAA Changes

Recommendations made in a \$104,000 management study of Civil Aeronautics Administration are gradually being implemented where feasible, according to Commerce Department's Assistant Secretary for Administration, James Worthy. The study, completed several months ago, will not be made public. It was the target of a vigorous attack last year by the late Sen. Pat McClellan who called it "a complete waste of funds."

Route Decision Delays

There has been considerable consternation in airline circles over the fact that JAL has come and gone without the long anticipated decision on route over from the White House. It has been expected that President Eisenhower would close his desk in his role as transport cases were concerned by year's end.

The impasse with the fact that Civil Aeronautics Board found itself spending last week with only four members as a result of the failure to appoint Oswald Ryan by his Dec. 31 nomination date or to a complete schedule, had the airline code perfect in a complete state of flux.

—Washington staff

Patterson Bombshell . . .

United to Spend \$50 Million for DC-8 Jets

- Expects delivery will start in 1960, possibly 1959, depending on Douglas commitment for USAF transport.
- Jet liners to use J57s; UAL chief calls turboprop talk 'shadowboxing,' says engines are unavailable.

By William J. Connelley

Los Angeles—United Air Lines will buy a fleet of jet transports this year, probably the Douglas DC-8 with Pratt & Whitney J57 engines, UAL president W. A. Patterson told top executives. When he exclusively last week.

Asked when he expected to place the order, Patterson answered "I hope it is in the latter part of the year."

■ \$50 Million Plus—Although Patterson did not disclose the number of planes he expects to buy, he said that \$50 million would be a conservative figure for the entire investment. United Air Lines is prepared to make for its jet transport fleet. He added that he expects the DC-8 price to be about \$8.5 million apiece, including engines.

Patterson said that he is anxious at a point date to have his jet transport fleet in operation, more it will take about five years to get delivery. However, he indicated that this might be advanced to 1959. Reviewing United philosophy he added "I thought a year ago that our decision on jet transport would be made in 1956-1957."

When the jet transport in the past has appeared unworkable, he said. "In the last six months and from January 1 received yesterday from the Douglas Co., it now is encouraging, and over 1,000 me, states the jet program to be better than the DC-68, which has been very satisfactory. It is that which has convinced me the time has come for jets."

■ Rejects Boeing Jet—Patterson indicated that United Air Lines is not interested in buying the Boeing jet transport, and said "We disagree with Boeing in that we don't want an air plane designed for the military; we agree with Douglas in wanting with a military designed for commercial use." Echoing on that thinking, Patterson indicated that for the USAF jet bomber transport competition, Douglas has proposed a military version of a commercial design, covering the normal auxiliary to try to obtain a military contract and then modify the design to meet civil requirements.

■ No Word from AF—Apparently Douglas has not convinced Patterson that it intends to proceed with its commercial DC-8 jet transport even if it loses the Air Force market competition. As of last Monday, Patterson said Douglas had seemed so good as to have it stood in that competition.

However, the manufacturer's account would depend upon release that the company could get from the military to build a commercial aircraft and from the jet transport production, should Douglas get a USAF order for the jets.

■ No Turboprops—The United chief executive told Aviation Week that turboprop transports are out of the picture at least for the time being.

"Talk about turboprops is shadow boxing. There is no engine available, he told the writer. "We will continue to buy the present type of aircraft, such

as the Douglas DC-68 and DC-7, for present service and then we will go into jets." "We think that if you buy a turboprop plane today, you completely can buy a jet and ship you by 1959 again."

Patterson said that United is writing off its present fleet of piston-engine airplanes in five years. He also disclosed that the airline has any interest in turboprops for short hauls. "We're going to wait out the Convair fleet," he said, and added that United cannot operate such an expensive new aircraft into small cities.

■ About 75 Passengers—He said he expects the turbojets to point on the commercial DC-8 to be about 75% in speed to seating, he pointed out. "There is quite a debate about that. We would like to see about 75 passengers. Others want to go to 100 or more."

Patterson believes United could schedule some flights carrying a lower number of passengers and in that way attract a larger total volume than wide-body, higher-density versions.

Concerning the DC-8's P&W J57, Patterson said, "The J57 by last June (1954) will have indicated of the amount of hours on it. I have been in contact with the industry and they tell me that the figure on maintenance of that engine are very low."



NATO Entry: Mystere Light Tactical Fighter

A lightweight tactical fighter version of the French Mystere is one of several aircraft submitted by North Atlantic Treaty Organization to Washington. In order of preference the design are: Mystere, Mystere, Folland Gnat, Aero and Fiat G-9.

Recommendations are based on apparent comparisons with NATO requirements for ground attack units, which is apparently why non-engineered Fiat Mystere could find on list. French entries would be preferred by British Officers' military staff jet.

Army Aviation Buying Fight Looms

Revamping of service's R&D setup indicates trend toward control of its aircraft procurement program.

By Claude White

U.S. Army has reorganized its research and development setup in what may be the first step to increased control over its aircraft development and production contracts.

Army aviation contracts now are approved by the Air Force, acting as procurement agent for the Army.

Army View—Immediate purpose of its R&D reorganization, according to the Army, is to insure centralized control and direction of all programs. The job has been given to Lt. Gen. Loren L. Lomax, Deputy Chief of Staff for Plans and Research, who will hold final responsibility for planning, arm and direction and supervision of all Army R&D.

The relation between the shift in control over development and aircraft procurement is remote at the present time. There is no denying, however, that top Army aviation men are less than happy with the present system. They feel this operation is handicapped by the fact that Army development and procurement money is channeled to the contractor by the Air Force.

USAF, they pine in private, sets its own interest in big bombers and fighters. Finally, light armor, helicopters and surveillance projects are stepchildren in Air Material Command's nursery.

End of "Off-the-Shelf"—There are high-ranking Army officers who feel it is inevitable that Army aviation will reach the point—possibly within a couple of years—when the service will have to buy its own (personal) development and production of its hardware.

This will mean an end to the traditional "off-the-shelf" procurement pattern.

The theory has been that the Army would buy helicopters and helicopters closely in production, much as they buy trucks from the automobile industry.

But the theory has not worked as well as expected, cluttered with some parts last spring at a meeting in St. Louis. Here the Army assembled its helicopter manufacturers and told them bluntly that the entire outlaying program is being prepared by the high costs involved.

Industry Viewpoint—Industry called on the industry to develop better transmission, rotor blades, engines and other components. It demanded long-term stability in "off-the-shelf" aircraft, but has no money or direct contact to provide

funds for development of such components.

"It is a good idea for the Army to tell us what is wrong," says one industry spokesman, "but until they are ready to sit out a check as part of an R&D program they are going to have to accept advances at the rate at which we can afford to make them."

The past year has seen a substantial expansion of Army aviation facilities. A major growth in the field of helicopter development is in progress.

Camp Keesler, Miss., is the new home of the Army's aviation school and the latest responsible for today's activity. A major growth in the field of helicopter development is in progress.

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greater autonomy in aviation research and development.

More R&D—New York—Specialists along their lines in what is Army aviation is present, but there are indications that the fiscal 1956 budget will call for a larger R&D program.

For the present, handling of the Army's public will continue to be supervised by the Transportation Corps, working with its designated agents in the Air Research and Development Command of USAF.

However, for the long haul, indications are that the Army will find it necessary to prepare its own assets in aviation. Control of the control over all R&D is the Office of the Deputy Chief of Staff for Plans and Research, but in effect on the eve of the new year, this activity is in a new level in Army organization.

It also may indicate a future close liaison between the aviation industry and the Transportation Corps of the military market.

Consolidation—Army spokesmen deny the consolidation means any change in the traditional autonomy of the individual branches over their own R&D programs. The more consolidation in Lomax's office function that will be held by the Deputy Chief of Staff for Plans and Research, but in effect on the eve of the new year, this activity is in a new level in Army organization.

But it is the measure of performance that counts. On the R&D put into new support, the Army was this machine will be valued by the industry sector. Then, however, will not lose its control over the production of new weapons. At the same time, Lomax's office will have an opportunity to coordinate main research when it is prepared to move them on branch of the service.

Army's shuffle in the field of R&D has been hailed as a move for the aviation industry to have better planning and more freedom. Many people have seen that the R&D effort was getting well without. It involved—depending on the project—personal organization and logistics sections of the Army.

Straight Line Command—Many reorganizations were made by the Air Force Committee on Army Organization, coordinate industries and the Army Secretary's ad hoc committee. All of them called for more efficient use of scientists and the Army is convinced that the reorganization will result in improvement.

"A straight line command was needed" is a top official told Aviation Week. "and that meant a five-year period which would be responsible for the whole program. We hope now that we have developed good cooperation by cutting R&D administration down to one staff."



MALES AT TAILPIPE are a design trick to improve speed. XF-102A was built in only six months, most just Mach 1 on second flight.

Design Changes Make F-102 Supersonic

Mid-air design design changes, built around more power, less drag and lower weight, make Convair's XF-102A delta winged interceptor supersonic in test flight.

On its second flight, made at Edwards AFB Dec. 21, the big plane passed through the Mach 1 wall in a climb to 55,000 ft. At that altitude, Convair engineers said pilot Richard Johnson looked out and accidentally looked into the supersonic regime.

He reported no buffeting and good control characteristics through the transonic range.

First test photos of the modified aircraft, which was built in 117 working days after completion of engineering, detail some of the layout changes.

XF-102A pictures are on p. 12.

Newer Look—From nose to tail, the XF-102A is now an aerodynamic detail. The nose has been lengthened and apparently dropped a little further to give better visibility over the tail at high angles of attack.

Change has been reengineered to take out the side bulge, it now features a new but still proved air intake similar to the engine on Convair's F-106. The D-11 engine, now air intake load the bigger Pratt & Whitney J57 turbojet, rated at 18,000 lb thrust with afterburner on.

Wing leading edge has been changed to improve lift characteristics of the new 10th stall, the number stage just short of the tip and the transition from it to the unmodified tip action gives an "uplift" wing.

Two hour ratings put at at each side of the tailpipe out, presumably to 60 in the chosen section between



LATEST F-102 (left) shows many changes compared with earlier model used to it.



NEW CASEPI has better side panel, lower back. Air intake also is different.

wing, fuselage and vertical fin and thus delay flow separation. This is a standard design to increase critical Mach number by a few hundredths.

Work on the delta-winged interceptor is done at the San Diego plant of Convair division of General Dynamics Corp.



DESIGN of new Martin XP6M-1 SeaMaster was influenced, much toward design of Navy's big seaplanes and photo-recon flying boat.



STREAMLINED HULL carries five-man crew, has watertight entry door down. Forward bulk allows daylight access to instrumented cabin.

P6M Role: Jet Seaplane Strike Force

Martin Aircraft last week unveiled the XP6M-1 SeaMaster, its last jet seaplane, and labeled it the peace weapon carrier of a "new concept in naval aviation"—the Seaplane Strike Force.

Primary missions of the SeaMaster are scouting and photo reconnaissance, according to Navy-approved data released with announcement that the first XP6M-1 has been completed and will fly this spring. However, the aircraft also was described as an attack seaplane and it was made clear that its 14,000-lb payload could be used to carry anything—including bombs.

► **600-Horse.** Class—Powered by four Allison T17 jet engines, the sweeping flying boat will cruise at 40,000 ft at speeds of more than 600 mph. This,

Martin said, is performance without use of afterburners, which are designed only to help get the aircraft off the water.

No figures are available on the size of the SeaMaster, except for the fact that the high T-shaped tail assembles towers nearly 35 ft above the ground. The hull is slender and was designed to help the aircraft perform as well as land-based planes in the same category.

The engines, producing 6,500 lb thrust each, are mounted in pairs at the top of the wing near the root. The intake ducts are oblique, designed to eliminate water problems as much as possible. Fuel tanks are sited in the wings, which have plastic skins in each end to support and balance the aircraft in the water.

► **Effective ASW Weapon.**—The XP6M-1 will be able to remain in operation for long periods, flying at altitude and can operate in SeaState 5, where the waves average six foot high. This indicates that the SeaMaster can operate in areas now 55 to 90% of the time.

Citing recent statements by Navy Secretary Charles S. Thomas and Assistant Secretary James M. South, Jr., in which they saw no limit to the potential use and ability of seaplanes, Martin said the SeaMaster is "the most effective aerial weapon now developed" to fight the submarine and be ready to launch cruise shipping.

The aircraft is equipped with a water-tight entry door in its belly, capable of carrying three crews, a auxiliary pod or



AFTERBURNERS are used to four Allison T17 engines as seaplane drops wing. Photo study from air prominently noted.



NARROW-BEAM HULL mounted on multi-wheel beaching gear which will be detached after 400 mph after flying boat is launched.



LOW RADOME carries radar scanner. Avionics compartment is below flight deck.



SWIFT TAIL towers at least three stories.

P6M Airliner?

Martin Aircraft sees good commercial possibilities in its jet-powered P6M SeaMaster.

The Martin company has a design available for a transport version of the new jet airplane, according to John W. Swettest, vice-president for sales.

"If the Navy wants a transport version," Swettest said, "we are ready to build it. The new aircraft would have commercial applications."

Part of the P6M is 30,000 lb. It is powered by four Allison J71 engines.

other weapons. Whatever the load, it can be loaded inside the door and removed by turning the entire mechanism over. Loading is easiest while the plane is on the beach but can be accomplished at sea, through a hatch in the roof of the hull.

■ Special Deck—The SeaMaster Striking Force concept calls for a team concept use of tenders, tankers, ammunition ships and the aircraft. A deck is developed, that of a building on a nontransportable ship and serving dual facilities for seaplanes that will be able to deliver to the Navy with the first test article in the P6M family.

The company already has built a portable deck that will permit servicing of the aircraft without beaching. When it is landed from the water, the SeaMaster will be damaged from the water on a detachable landing gear equipped with floats to facilitate floating it to the hull.

High performance of the SeaMaster, Martin says, "We don't see a back seat in any land-based aircraft in load, speed or range"—a made possible, according to its designers, by the high-lift devices and aerodynamic advances. The aircraft runs at less than that of a land-based aircraft of equivalent size, Martin claims.

■ Five-Man Crew—In service, crews are, the SeaMaster Striking Force will complement and strengthen U. S. operations in many areas where we lack reinforced land-based striking forces. The dispersion of these forces, it is held, would make it nearly impossible for an enemy to defend itself against all at once.

The new airplane carries a crew of five men, including pilot, co-pilot, weapons officer, radio operator and instrument display operator. Only visible armament is a tail gun. There is a release in the bow with a radio antenna.

No light, the plane can be perceived

to 21,000 ft against a true altitude at 30,000 ft. There is a pressure lock for entry to unpressurized areas during flight.

■ Crew Toilet—In addition to the pilot compartment, upper part of the hull contains a flight deck for the crew and an entrance where another person is stored. Under the deck, the SeaMaster has an electronic and electrical compartment, the pressurized area and the main bay. This compartment includes a parking of the main wing in the upper section, fuel tanks, noncontaminating and anti-icing equipment and tanks with a small facility on which crew members can pull themselves back and forth above the stairs.

Back of the main bay and under the hatch on top of the hull is the non-loading compartment. Back of this are most electronic gear and an auxiliary powerplant.

Like a simple to those on the Martin P5M Martin, too on both sides of the hull already Opened together, they serve as a landing, opened separately, they act as egress to enter the aircraft on the water.

Engine overhaul and replacement will be performed through large ports that can be swung open for maintenance work while the plane is on the ground as well. There are emergency escape facilities for the crew.

MATS '54 Record: 10,000 Oversea Trips

Military Air Transport Service flew about 1.3 billion passenger miles, 100 million payload miles and 200 million ton miles across 110,000 miles of global air routes during 1954.

Records of MATS three transport divisions:

• **Pacific.** Aircraft from this division around the Pacific 5,816 hours carrying approximately 230,000 passengers and payloads and 15,000 tons of cargo and mail.

MATS claims an excellent record of 3 hr 9 min in a C-97 on the Tokyo-Honolulu flight, an average speed of 421 mph, versus the 3,567 mi distance.

• **African.** Approximately 4,000 trips were made across the Atlantic carrying about a quarter million passengers and 49,300 tons of cargo.

• **Continental.** This division carried about 30,000 passengers and payloads and carried 8,476 tons of high priority cargo and mail.

"MATS not only carried out its passenger support of the armed forces," Lt. Gen. Joseph Smith, the service's commander, said, "but also gained invaluable training in its working job at providing strategic airlift for the entire Department of Defense."

In addition to its transport duties,

MATS free pilots delivered 6,990 aircraft throughout the world in 1954. Largest single ferry mission in MATS history was the six consecutive 500 F-86D fighters assigned to the fighting at Dien Bien Phu in Indo-China. The wounded were down three quarters of the way around the world in Operation Winstedt Warsaw.

House Group Asks Probe of Subcontracts

A thorough congressional review of Defense subcontracting policies in case of the wide area of subcontracting moving from both the direct subcontracting operations and the alleged effects of the weapons system contracts is called for in the current report of the House Small Business Committee.

Utilization of government-owned facilities and equipment and administration of contracts awarded under the weapons system should be emphasized in the investigation, the committee said. Other points made:

• "It is increasingly apparent that questionable or inadequate statistics have seriously hampered the proper evaluation of how smaller producers fare in the defense program." More procurement officials "regard a percent cost as 'acceptable' in performance by small business only if the contract has in fact been awarded to a small firm."

• Because of reports listing the volume of contracts to the 100 largest military prime contractors should be reviewed.

• Purchasing policies should be reviewed by Congress to determine whether the large volume of negotiated contracting is warranted.

U. S. Sets Aircraft Export, Import Fees

A new schedule of fees for the licensing of aircraft imports and exports will go in effect Aug. 1, according to the Department of State. The fee applies to aircraft classified as instruments of the Department of State. The fee applies to aircraft classified as instruments of the Department of State.

The schedule provides for a variable charge ranging from \$1 for a license of \$100, to \$50 for a license of \$100,000 and over. For shipments valued at less than \$100, no license is required.

Aircraft firms can submit fees with each application for a license. It is possible, State Department says, for regular registration to make advance payments to cover expected charges over a period of six months or less.

The license is administered by the Office of Munitions Control, Department of State, Washington 25, D. C.

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921



"ELFAKA" OVERLAIN LIGHTS are back with runway at Amsterdam's Schiphol Airport.

U.S. to Try Dutch Approach Lights

Joint USAF-CAA evaluation of "Elfaka" may solve long civil-military pilot battle on lighting configurations.

An American evolution of flash approach lights, a Dutch development already in use in The Netherlands and Denmark, will be tested next year as a test project of the U. S. Air Force and Civil Aeronautics Administration.

There is some hope, particularly in commercial aviation, that the tests will result in adoption of the flash light and final resolution of the long controversy between military and civilian pilots over approach light configurations.

► **Five-Group Test**—Installation of the system will be complete by spring, and the evaluation report should be ready by early fall of this year.

In addition to CAA and USAF pilots, the device will be tested by representatives of the Air Transport Association, the Air Line Pilots Association and independent pilots. Site of the installation has not been selected.

CAA's present technical standard order on approach lighting is only a few months old (AVIATION WEEK Sept. 27, p. 99).

It provides for two configurations:

► **Type A**, initially developed by the British and accepted as an international standard, has a 1,000-ft. centerline of white bar lights leading to the end of the runway. There is a crossbar 1,000 ft. from the end of the runway, marked by a green threshold bar. This is the ALPA-AFA centerline system.

► **Type B**, a USAF configuration, has only 2,000 ft. of centerline lights, in red instead of white. They stop 1,000 ft. from the end of the runway with a red crossbar. The final 1,000 ft. before reaching the runway is clear and called the "crossrun area," marked on the right by a single line of red lights and on the left by a triple one.

► **Aviation Institute of Canada's** order provides for Type A to be installed at civil airports and Type B where an overrun area is needed (reports shared with USAF). This type of installation increases a major source of ambiguity to airline pilots.

USAF demands an overrun area for runways accepted as round by CAA's.

► **Military pilots**, particularly fighters, have poor forward visibility during landing and a single center line of lights frequently would be behind the nose of the aircraft.

► **Military planes**, particularly jets, have a longer range between the optimum approach speed and stalling speed. A slight error can result in undershooting the runway, and an area must be provided where touchdown can be made without hitting an obstruction.

► **Military pilots**, exposed to a greater calculated risk than commercial pilots, usually have less experience than professional transport pilots.

► **Military pilots of fighter planes** are slow and lack the maneuverability and skill of a cockpit during the initial approach and landing.

► **ALPA Objections**—The USAF overrun area is frowned upon by ALPA pilots as an unnecessary hazard fraught with something that approaches technical difficulty.

There are only USAF runways on extra 1,000 ft. of clear space regardless of the runway's length, whether the strip is 4,000 or 10,000 ft. long. An airplane, they assert, can land within a certain number of feet of runway and there is no part of the performance characteristics that calls for 1,000 ft. to be added to that figure at all events.

According to CAA, the only reason

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For further information, write

In addition to the joint CANARAF conference program for the flash light, the two agencies today are considering establishment of a joint committee to study the coffee landing and problems at port and airports. Given agreement on adoption of a flash light that will resolve the civil-military conflict in this area, it is highly possible that other differences will be settled by joint action.

Fiberglass laminated parts produced for the aircraft industry by the Palo Verde Chemical Co. are described in illustrated brochures available from the firm at Box 686, Fremont, Calif. Properties and shapes of Teklon products are described in "Sponge folder produced by Macomold Products Corp., 11 Centre Pl., Yonkers, N. Y. ABC's of extruded and extruded rubber and plastics are covered in 16-page lay-out guide available from General Tech-

Comprehensive reference file on the complete line of Mason and Chatham for indexing, increasing and back-stopping operations, is contained in Bulletin C 11-54 A, B, C, D, E. Write: Morse Chem Co., 7800 Central Ave., Detroit 33. New annual shows how a single *Dithionite* brand can be converted into a bar fertilizer, an



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APR 1964 WIDE. January 10, 1965



TABLE TEST at Bell's Westfield plant typifies intensity of rocket development effort. Jet at several rocket has blasted more deeply.

Bell Builds Rocket Engine Knowhow

By David A. Anderson

Bell, N. Y.-An aluminum alloy rocket motor, which can be built quickly and cheaply from standard alloys, is a serious high-water mark of Bell Aircraft Corp.'s intensive rocket motor development program.

Experimental aluminum alloy units have been fired with up to 4 propellant combinations for continuous time of almost 16 seconds duration; indi-

vidual sections have logged more than one hour—a long life under the rigorous conditions of rocket combustion.

With 21 test cells in operation at their Westfield plant, and a backlog of more than 16,000 individual motor runs, an AC-119B, Bell's liquid-rocket development plant is one of the country's largest.

▶ **Motor.** Part-highlight of a recent trip by Aerospace Week's editors through Bell's extensive facilities was

a five-minute run on one of the aluminum alloy motors rated at about 6,000 lb. thrust.

The motor was mounted on a typical thrust-measuring stand in a reinforced concrete test cell. Control and instrumentation housings are behind a protective shield into the adjacent control house and back to the instrumentation room.

Inside the control room, the test engineer stood by the operator's panel, which he could switch the performance of the motor through the thick bullet-proof glass windows on into the launch walls. Behind him stood another man wearing glasses to watch the clock and other data on the instrument panel.

Two rubber-boated technicians clamped into the control room through the steel blast door, and dangled it closed. The run began its roaring silence. The operator started the test run.

▶ **Smooth Operation.** To the observer whose run has been hardened to the tortured shrieks of rapid combustion, the loud and explosive clatter, the swish-eat of the Bell unit was remarkable.

The start was positive; thrust built up rapidly but without the explosive heaving that is characteristic of so many motor runs. Shock dampers, the visible submergence of supersonic flow in the ex-



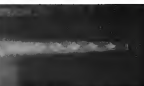
ATTITUDE TOWER can support complete motor or portion of any desired structure under full thrust.



RECORD ROOM handles immediate amount of rapid instrumentation data, records it on Sperry-type units. This is smaller of two such rooms.



PRODUCTION LINE of motor sections. Then 3 barrel propellant typify liquid-propellant rocket design.



RAMJET in exhaust from liquid-propellant rocket engine; fuels tank quick check of engine operation by their readings, not and clock.

haust jet, were unaccounted yellow against the darker yellow of the flame, their position varied only once during the run, and that was when the motor was being changed deliberately.

For several days outside the motor blasted as an unattended motor across the concrete space behind the test cell, its noise was deafening even through the thick protective walls around the control room.

Behind the engine controlling the run stood another engine with the clock. The hand swept toward shut-down time; at the mark, he stopped the test engine, signaling for the shut-down. The propellant valves were closed. There was no flame recognition, no pulsing, no uneven combustion. The motor and the motor simply stopped.

▶ **Instrumentation.** During the run, remote instrumentation in one of two large control rooms was monitoring the mass parameters of the test. All data were being fed through peripheral-like large telephone switchboards into Sperry-type recorders, oscillographs and other test instrumentation.

After the run, the test points of 60 to 80 parameters are stored on IBM

cards to add to the accumulating mountain of basic data on motor and propellant. When some engineer wants to find out the effects of various ratio change, or chamber pressure change, or words in concrete data from similar runs, the punch cards are run through and he gets his data in minutes instead of days.

Bell has two instrument and control rooms, with both are hard with Sperry-type recorders and test equipment. There are 60 units in the small room, and 120 in the larger room, still being completed.

Sperry handles data that appears up to about 60 cycles per second. Geologic-like level of the frequencies up to about 100 cps, and special instrumentation developed at Bell records measurements up to 8,000 cps.

Work load for the test cells and instrumentation peaks at about 20 runs per day; the work for automatic recording and processing is obvious.

▶ **Bell Goals.** One of the aims of the rocket program is a high specific impulse, William M. Smith, Bell's chief rocket engineer, told Aerospace Week. Specific impulse is the rocket engineer's way of rating an engine; it is a

number defining the pounds of thrust obtained in consuming one pound per second of propellant. Symbol for specific impulse is *I_{sp}*, units are seconds. Specific impulse could also be considered in the language of specific heat consumption. Typical values for current rocket motors are about 200 sec., and as high as 240 sec.

Motor developed at Bell are running close to these practical efficiency limits now, so that new propellants are being investigated.

Smith said that Bell was beginning to study data concerning motor performance, in order to pick up more performance gains.

"We've had no problems with combustion instability for the past year and a half," Smith said.

▶ **Motor Design.** Typical rocket motor consists of three basic parts: an injector head, through which fuel and oxidizer are fed to the motor; a cylindrical combustion chamber, and a convergent-divergent supersonic nozzle.

An enormous amount of heat is generated in a true volume, and produces the major problem in rocket motor design—efficient cooling of the motor.

There have been two solutions to the



AERIAL VIEW OF WESTFIELD plant shows long row of rocket test cells. Next cell, current test facility to be added, discharges toward rock breakers.

problem. The first is to let the water tank uncooled, protected by a high-temperature-resistant liner. This is the solution presently adopted for sub-propellant motors where the thrust location is a matter of few inches, or the liquid-solid status of oxidizer performance.

The second is to use the fuel as a coolant, by circulating it in a jacket around the combustion chamber and nozzle. This concept is called a "regenerative motor."

• **Roll Standard.** The standard motor under test and continuing development at Bell is a single thrust chamber of regenerative design. The development of this kind of motor has gone through several stages, including the chemical aspects of the combustion motor.

Many motor nozzles are designed with concentric ducts. The body is housed of two high-strength steel (generally a titanium alloy) cylinders separated by a ductwork in the center of the nozzle. In this latter case, fuel is circulated from the nozzle toward the head in order to cool the motor.

Other structural variations have been tried in Bell and elsewhere, but the basic design is common to all a combustion chamber, jacketed and cooled by one of the propellants. Most special design solutions remain classified.

One of the most exciting current developments in rocket motor design is the aluminum-alloy motor, credited to Harry S. Myers and Joseph B. Pauls, senior test article team. Usually of regenerative layout, the aluminum-alloy motor is radically simpler and lighter than steel.

• **Other Work.** Searchers are there in considerable variety in rocket motor development at Bell's, in addition to production of complete propellers. It has been reported (Aviation Week Dec. 11, p. 11) that Bell is building solid motor for the Army's Nike anti-aircraft missile.

"We make our own valves, nozzles, agitators, turbine pumps, tanks and pressure vessels," Search says, explaining that components for solid propellant have to be matched carefully to the particular grain. For each stress or production problem with any other manufacturer of equipment, so Bell is forced into building its own.

In the case of research aircraft like the X-1, the powerplants were developed elsewhere to Bell specifications. On the X-1, X-1A, B and D, powerplant responsibility was given to Reaction Motors, Inc., Bell set the measurements and after delivery, assumed the responsibility for maintenance of the engine.

On the X-1, a similar arrangement was made for the Curtiss-Wright turbojet engine.

Concordance research calls a group into contractual motor for USAF, Search adds. In this development, a contract is used in the nozzle and in a chamber liner.

"We have done some work on variable-thrust engines, too," says Search. "But using a number of motor units probably is a most applicable."

• **Two Facilities.** Bell does its motor development at two facilities. Wheatfield plant, where the major research and development effort is centered, and the nearby Bell Test Center (USAF Plant No. 10) operated for the USAF. Wheatfield has 23 completed test cells, with four under construction. Most of the work done there is on single chamber motors, a pump, a turbine and fully into the category of research or development.

Operations at the test center are divided into two phases. The first is a complete testing of deliverable hardware, such as a complete motor or a complete powerplant system. The work is applicable from the motor development work, and is administered by Bell's Test Dept.

The second phase is research and development on complete units, which is under Search's jurisdiction. "We are

handed up to 10,000 lb. thrust at the test center," Search says. "And maybe we could go to 100,000 lb. thrust. We hope to complete our large powerplants in that thrust bracket."

• **Research Section.** Bell is doing a large amount of fundamental research in areas of possible application to rocket motor technology. About two-thirds of the work of the research section, under Thomas Beckwith, is applicable to specific projects, the remaining one-third on independent contract.

Research section is divided into three groups: materials and propellants, heat transfer and fluid mechanics, and combustion.

Typical of the work of the section is an investigation of heat transfer by electrical analogy. A specially prepared paper with surface conductivity is used, and voltages are applied at points simulating transfer into a sheet of metal. Voltage distribution and drop can be measured, and with analogy, heat transfer data can be obtained.

Since work is going on in the development of the fluid mechanics of fuel and oxidizer droplets, Bell scientists believe that if they know the aerodynamics of fuel droplets mixing and combustion,

they will be able eventually to choose the combustion chamber of a rocket motor.

Currently, the quantity of rocket or ground personnel at Bell has leveled off at a little more than 500. Working under Search are 177 engineers, 65 designers, 315 technicians and 61 in supporting services.

• **Where Bell-Search** said that the real future for rocket development lies in intercontinental and satellite vehicles, and that Bell has more work than it can do about these future applications.

The company's rocket staff already has attracted some attention because of the successful growth of their company in various missiles.

Three Atlas rockets in the early powerplant field were tested, and will undoubtedly be built on the strong foundation of 10 years' experience with a variety of solid propellant combustion tests, including nitrocellulose, hydrogen peroxide-hydroxide, chlorine azide-hydroxide, and solid JP-4.

THRUST & DRAG

Once in a great while, an aviation book comes along that is most reading for every aviationist, for every engineer, for every pilot who flies in World War II. Such a book is Alan Martin's "First and Last I Fly by the Father-Son Flying in My Life."

Martin's first encounter was the famed "Rocketeer" story by Father-son, written by Father-son, published by the U.S. Navy. Martin's first encounter was the famed "Rocketeer" story by Father-son, published by the U.S. Navy. Martin's first encounter was the famed "Rocketeer" story by Father-son, published by the U.S. Navy.

Martin was that strange phenomenon, a Luftwaffe pilot who was a Nazi, who believed that the Germans and the Allies were equally determined to beat the Germans, and who was frequently at odds of his experience. Through the radio war, he first saw several enemies at the factory. He was never called in. He was never called in. He was never called in.

Martin was developed only later, both times by a general under which dropped everybody else in the Luft with the Kettel's Cross of the Iron Cross, Second Class, with Second Diamonds, and Grand Knight's Cross. Orders were ordered by Martin, but sometimes he questioned them. These were those who he suspected that maybe his wing commander was sleeping a little, but he never questioned

the ability of Hermann Goering. In fact, he asked him to be the boy, and even he, Goering, his words, his actions, his actions.

By and large, Martin was satisfied with the amount he had in his life. He thought the Me-109 wasn't a bad airplane, and when somebody asked him if he'd like a squadron of Spitfires to fight with, he turned it down, saying something about maintenance being a bit difficult under the circumstances. When the fall of Berlin seemed imminent, and Goettinger was being played in the wings, Martin was stationed at an airbase near the German capital. Having no work to do with

Hitler, and not caring whether he saw him again (because that they had never been formally conversed), Martin climbed over his plane and took off to join America, a little while in the Russian Alps near Garmisch-Partenkirchen.

After an eight-hour journey, he was on the point of straining to death when he wrote and successfully sold his memoirs. The thoughts that haunted him in his long journey through the insanity of war and the tragedy of flight are best expressed in Martin's own words:

"What the hell, it's just another job—HAA."



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McDonnell's New F-101A—And How It Grew

Comparison of McDonnell's new F-101A Voodoo (top) with the XF-101 Voodoo from which it was developed, shows some of the many external engineering changes in the new jet, notably in the tail section and engine installation. Not so readily apparent in the sketch is how the XF-101A is 6.6 ft. long, compared with the XF-101's 10 ft. 10 in. Even less basic change is shown, the XF-101A being 2.4 ft. 10 in. long, the XF-101 being 2.4 ft. 10 in. long.

while the later Voodoo has two 10,000 lb. thrust J47s. The XF-101A, which first flew in 1948, was an early in the Air Force language prototype—the fighter competition for which the Lockheed XF-100 and North American XF-108 also were built. The project was canceled. McDonnell's new F-101A is 6.6 ft. long, compared with the XF-101's 10 ft. 10 in. Even less basic change is shown, the XF-101A being 2.4 ft. 10 in. long, the XF-101 being 2.4 ft. 10 in. long.

TYPE
R-149

EEECO's select Type R-149 linear actuator is actually self-contained. The motor, clutch planetary reduction gear and limit switch are all enclosed within the compact linear cylinder. Type R-149 has an unusually long stroke of 18.75" at 2" per second under a normal load of 4,000 lbs. at a 20 volt DC output. Maximum open load load is 8,000 lbs. EEECO's standard Type R-149 has adjustable limit switch, end position, and safety end stops, and a motor that shuts off automatically when end stops are reached, or load exceeds a preset limit. Weight is 13 lbs. 5 oz.

Need Special LINEAR ACTUATORS?

EEECO can save you valuable development time and expense and speed the delivery of actuators by offering one of its many tested and proven linear models to fit your specific need.

Shown here are a few of many EEECO self-powered and remote-controlled mechanical linear actuators that have been designed, developed, tested and produced for various air frame manufacturers. There is a definite possibility that one of the actuators illustrated (or others not shown) can be adapted to your specific need as to load, length of stroke, rate of travel, or other characteristics.

Illustrated at right is a group of EEECO actuators designed for electric, electric and line hydraulic control. Powered by the EEECO Universal Power Package they can be operated remotely or in groups to actuate windows — a door for the example. These and many other custom designed EEECO linear actuators can be adapted for specific purposes with a minimum of expense and delivery time.

EEECO's flexible Universal Power Package drives single or multiple screw jack actuators, either rotary or linear forms of which are illustrated at right, with direct or flexible shaft connections for remote operation. The compact 3 1/2" x 3 1/2" x 3 1/2" power package is only 7 1/4" x 4 1/2" x 2 1/4" in size yet contains motor, valve, solenoid, magnetic clutch and brake, reduced gear and planetary gears operating adjustable limit switches to control travel, light switches and manual inhibitor. Specifications can be changed to suit special requirements.

FLEXIBLE
UNIVERSAL
POWER PACKAGE

TYPE
D-649

TYPE
D-458

TYPE
D-607

TYPE
R-129

EEECO's Type D-649 linear actuator weighs 13 lbs. and operates with a stroke of 26.25" at 10 mils per second under a working load of 3,400 lbs. normal tension and 4,200 lbs. peak tension at a 20 volt DC output. Maximum static load is 10,710 lbs. It has a built-in shock drive take-off, load limit switches, non-jumping end stops and a retractable stop that adjusts to within 1/8 inch NPS in static expansion and delivery time. EEECO's Type D-649 can be supplied for various loads, lengths of stroke, rate of travel and other characteristics.

EEECO's Type D-458 linear actuator for jet wing flaps weighs 8 lbs., 2 oz., has a stroke of 5.14" at 4" per second on 20 volt DC output under a normal load of 3,000 lbs. Maximum static load is 30,000 lbs. compression in fully actuated position. Type D-458 has non-jumping end stops, provision for power take-off or hand drive input signal and radio noise filter. Limit, stroke, rate of travel and other features of EEECO's Type D-458 can be changed to suit specific needs in a minimum of time.

EEECO's Type D-607 is a linear actuator for transport aircraft cabin windows 4.8 lbs. and has a stroke of 4.25 inches. Linear rate of travel is 22" per second at the rated load of 100 lbs. compression. Maximum static tension load is 3,000 lbs. EEECO's Type D-607 has non-jumping end stops, adjustable limit switch, radio noise filter and operates at a 20 volt DC output.

EEECO's Type R-129 is a shiftable actuator for large jet fighters. It is a completely automatic remotely manipulating line motor, 1/30 hp and 2.2 lbs. operating through gear reduction to give a drive rate of 6.125" per second and 7.125" per second respectively to the screw jack. Normal operating load is 11,000 lbs., static load is 20,000 lbs. The screw jack operates almost constantly with automatic pilot, while the larger motor provides for manual pilot control at a higher rate of maneuvering. Type R-129 operates on a 20 volt DC system, has overload and limit switches, radio noise filter, position indicator, non-jumping stops. Weight, 45 lbs.

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'Smear' Camera Gives Highspeed Record

A new tool for the research laboratory showing the progressive action of explosives, shock waves, gas discharges or tube flaring, is an ultra-highspeed camera system recording time space data at a sweep speed of 5-45 mm. per micron-second, with duration of 45 micro-seconds.

Schlieren interferometric effects may also be captured with the equipment. A camera rotating in a vacuum at actual speeds to the 24,000-93,000-rpm range reflects the image onto the film, sweeping it across a vertical area representing space and a horizontal area representing time, providing a "sweep" recording of the transients of the test. Film size is 4x10 in.

Synchronization between the camera and event to be recorded is by an electronic measuring unit producing a sharp, positive output pulse of approximately 250-v. peak and 10-sec. firing the event.

Auxiliary features include a secondary output pulse that can be used as a microphone output trigger for recording time-lapse measurements.

Manufacture of the semi-enclosed circuit camera (Model 165) is Remler-A Whittier, Inc., 985 San Carlos Ave., San Carlos, Calif.

BUT STILL WE FLY

An airplane crash is one of the most startling headlines of this modern world. Most of us, at one time or another, ride in airplanes. Many of us, we must think, however, make tomorrow's project. That statistic says we are about to ride in the air as we are anywhere. More than two and a quarter million passengers pass through Elsworth Airport every year. Consider it in our rear. Down to last Saturday, had taken the form of air or more correct, passengers and crew. The number of exposures we can take in a given place plus that on a highspeed end.

But the crash and the air crashes. It is hard, for example to think of a 747 jet, just before Christmas morning hours for a happy holiday—and then, a crash. Shut off the end of a concluding year on January 1st. These details not dry to all.

But an airplane crash will dominate us from taking to the air whenever we are in a hurry—or perhaps for the sheer pleasure of riding. The high speed the level of the plowing and earth-bound. One plane goes down but ten thousand safely take off and land. We cannot the dead we never learn, but we will be in our seats, and our newspapers and on those the clouds the glow of sunset and dawn.

Editorial, New York Times, Oct. 25

AVIATION WEEK

THE MAGAZINE OF AVIATION BUSINESS

ROBERT W. MARTIN, JR., PUBLISHER

A MEMORANDUM PUBLICATION
240 WEST 57th STREET, NEW YORK 19, N.Y.

MEMORANDUM TO THE AVIATION INDUSTRY

On March 14, 1955, AVIATION WEEK will publish "Airpower in the Age of Peril," the 22nd Annual "Inventory of Airpower" Edition. In this annual number which has gained world-wide readership, AVIATION WEEK editors will report on the story of the Aviation Industry's transition from the Korean crisis buildup to the solid Industrial and Military Airpower base necessary to meet the growing requirements of the new U. S. Defense Policy. "Air Power in the Age of Peril" is of vital importance to all those Aviation Management Men, Engineers, Military and Government Officials whose efforts and interests are devoted to the expansion of civil and military aviation and the defense of our country.

Editorial assignments have been made to 17 AVIATION WEEK editors for special reports and articles. Traveling schedules are presently in force and a voluminous amount of material is now in the process of collection. In all, this outstanding issue will add to the record of usefulness of previous editions and establish new standards of factual presentation and reporting.

For advertisers, the 22nd Annual "Inventory of Airpower" Edition offers 1955's most appropriate spot for your sales message. I heartily recommend its use to all Aviation Manufacturing Companies and Suppliers as an outstanding 1955 editorial presentation.

Sincerely,

Robert W. Martin, Jr.
Robert W. Martin, Jr.

The 1,000th C-119 Flying Boxcar rolled off the production line at Hagerstown, Md.,



on schedule, and was accepted by the U. S. Air Force. Fairchild is proud of the pilots, crews and



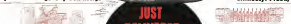
maintenance teams who have made the Flying Boxcar famous the world over as a depend-



able workhorse, giving increased flexibility to our Armed Forces—a symbol of American



production ingenuity and design efficiency. Proud,



too, of the thousands of Fairchild men and women whose



combined skills have made this production record possible.



...Proven in combat and in peace, proven in tropic and arctic opera-



tions, this great world-wide team of C-119 Flying Boxcars is now joined by its 1,000th member,



as together they reach new heights as an indispensable part of America's flexible armed forces.

ONE FLYING BOXCAR COULD CARRY
ANY LOAD PICTURED ABOVE
1,000 C-119 FLYING BOXCARS
COULD CARRY 30,000,000 POUNDS
OF EQUIPMENT AND SUPPLIES, OR

40,000 troops with full field equipment
1,000 jeeps and four-wheel
1,000 jeeps and four-wheel
1,000 jeeps and four-wheel
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1,000 jeeps and four-wheel

Typical of the many vital jobs assigned to Flying Boxcars is the Air Transport Service, established by the United States Air Force in Europe. Because of the Flying Boxcar's military flexibility and dependability, Army scheduled cargo flights are being made possible. A service team is equipped, and is now in operation, which ensures regular delivery of approximately 4,000 tons a month of vital military supplies and equipment at tremendous savings to our government.

Order to Fly in the U. S. Air Force



"Order to Fly in the U. S. Air Force"

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PRODUCTION

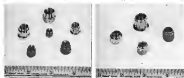
Esso Official Tells . . .

What's Delaying Titanium Fastener Use

• Wide application of the metal in locknuts waits on advances in metallurgy and manufacturing techniques.



EXPERIMENTAL 18-8 SS FIBRE LOCKNUTS—Anchor (top left) and floating anchor with (center) have titanium alloy bodies, respectively fixed to post titanium base and secured in steel "hacket", bottom, silver-plated stainless steel beam-type nuts in titanium channel.



NON-FIXED channel beam-type locknuts made of titanium alloy have threaded collar drilled in from elastic base.

ELASTIC INSERT represented titanium alloy locknuts made by Esso. The elastic inserts in these cuts are made of nylon.

elastic insert type, the drilled beam type, and the elastic membrane type.

Esso Findings—At the time the program started there were only two as these titanium alloys available, and these were in a very early stage of development. Esso was looking for a yield strength greater than 125,000 psi, and sufficient ductility to permit the torque setting operation for insert as being type investigations. Of the materials studied, the BC-1120 alloy came closest to Esso's requirements. However, it has limitations, particularly from the manufacturing standpoint, Esso claims Esso adds.

In early stages of our program much was accomplished, due to variation in the material received. To a certain degree this is an major test factor. We have observed age

cracking, reduced fatigue strength, variations in hardness, and lack of homogeneity of material, in practically every lot at prototype runs we have made.

"We also find creep unpredictable. Work we have done at room and elevated temperatures shows more study is required to develop creep characteristics before we can be assured of completely reliable fasteners. Reliability curves are more desirable.

It has been observed that titanium accelerates the corrosion of boronable metals in composite fasteners and construction. This might be of considerable concern to the aircraft industry, since it is possible titanium bolts and nuts will be used in faster aluminum as well as titanium and stainless steel structures.

Attack on Galling—"We have ob-

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*Reg. U. S. Pat. Off.

saved large variations in the thread form and wear of performance of turbine vanes (left), both these various sources, although there has been a notable improvement in these characteristics lately," Duke says. "Both conditions were a by-product of self-lubrication performance, and the effects are out-gassed in the case of titanium fasteners since galling and wear character also are a direct function of the fit and finish of mating parts."

Exco has done considerable study of the galling problem. With Associated Chemical Print Co., it engaged in an extensive program to develop an etch-free and permanent lubricant, which is a development by American of their L-666 lubricant for threaded titanium parts. This is similar to a phosphate ceramic lubricant, and is permanent even when exposed to elevated temperatures.

Use of the lubricant permits reuse of titanium after lubricants in removal with applicable AN specifications, and thereby cut the high-tension relationships for fasteners employing titanium parts.

► **Manufacturing Problems**—There is a close relationship between the design of a self-lubricating nut and the lubrication problems associated with making this nut in volume. Hand tools with deep cuts under power are required for titanium alloy, resulting in a cut cycle time four times slower than that for steel.

A good portion of the cost of a machined titanium alloy nut lies in the scrap material consumed, and so for this scrap has little or no real value. But it would be desirable to start with a forged and ground nut blank which would require only finish machining operations, Duke claims.

Such a program will require long and expensive development and, if successful, will mean expensive nutties for tools and equipment.

The manufacture of titanium alloy nuts from sheet metal also shows an admirable promise as a means for reducing cost. Exco is beginning research in this field.

► **Healing Difficulties**—Design for air-cure welds employing Exco's electric arc-bonding technique are all of the two-piece type. At the present time the engineer has not worked out techniques for healing another weld from titanium, but is sure. This will be a long and costly program, Duke says, and fabrication now is on some cast alloys.

There does not appear to be much more in processing a low speed low to produce a nut whose body is only 1/2 in. wide, though its length in cutting surface are 1 in. wide. The scrap loss would be more than 75%. An small a



Remanufacturing a new engine section is a complex, highly specialized operation.

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**WHAT DO YOU NEED
TO TAKE A
TAILPIPE TEMPERATURE?**

**FOR ONE THING,
A GOOD HARNESS.**



It's tough to take the temperature of a jet's tailpipe. Severe vibrations and extreme changes in temperature can wreck measuring equipment. Yet, the information is vital to keep your build the engine and fly the plane.

The harness used for the job must be rugged enough to survive brutal operating conditions (even more brutal than that engine throat and temperatures are being measured).

T-E has several solutions to the problem, and the rigid, ladder-type harness shown below is one of them. Extension wire is protected from the heat, corrosion, and abrasion by one piece, stainless jackets which are lined with ceramic insulation. Positive and negative conductors are protected separately for convenience and ease of installation. Harness can be equipped with open-end or stagnation thermocouples.

Briefly, it's a well-made harness that can take lots of punishment and high temperatures.



Completely enclosed connector is made of thermocouple materials—corrosion, light weight—no wires from thermocouple and/or sensor connector—no problems with vibration and high temperatures, 3000° F or more.

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IN CANADA—THERMO ELECTRIC (Canada) Ltd., BRAMPTON, ONTARIO

yet body as possible is machined from bar stock, and welded, brazed or coated with a permanently protective chromium-silver metal base.

Even bar had difficulty in doing it titanium alloy yet body to a pair of titanium nut base. The alloy with which it is working do not lend themselves readily to welding techniques, Delle says.

He sums up Delle's current position this way: "We can produce and are producing titanium alloy locknuts in small quantities for the manufacturers in aircraft production by the aircraft industry. These do not appear to be an insurmountable problem associated with quantity manufacture by conventional means but these practices result in undesirable costs because of scrap loss, slow machining cycles, and increased tool maintenance." Two major obstacles, he says, are availability and cost.

Cost at Savings-Little more than a year ago it was estimated that Delle alone could not meet the demand for the small amount of titanium alloys, if it were to convert only part of its present steel line to titanium. This problem obviously puts large-scale weight savings from titanium alloy locknuts well into the future, Delle concludes.

In a given locked connection approximately 75% the weight is due to the bolt and 25% to the nut and washer. The rest is by far the most complicated member, known even expensive to manufacture. It is also the portion of the fastener where the potential weight saving is least. So while it seems very desirable to change the bolt material from steel to titanium alloy, the economics of switching to titanium alloy nuts, under present conditions, seems further away, Delle maintains.

"We are characterizing," he says, "the use of the concrete No. 13 steel bolt nut. One million pieces of this nut weigh about 5,000 lb. If this one million pieces were converted directly to titanium, the weight would be about 3,600 lb—a weight saving of 2,000 lb. The one million steel nuts would cost about \$9,000, including a material cost of approximately \$1,400.

"The same million nuts in titanium would cost, he estimated close, in excess of \$168,000. . . . On material cost alone, we would be increasing cost by about 500 per cent of weight saved. They figures would be at least doubled by slower machine cycles and increased tool costs. . . . So we can estimate the weight savings would actually cost a minimum of \$200 a pound.

"We find it hard to believe that such savings could be as appreciable for production aircraft, and as again it would appear that quantity utilization of titanium alloy locknuts in the future. We have said the most



**SPINS LIKE "BLAZES"—
so Radiography checks each one**



Radiograph of oil swifter rotor in variable displacement pump for aircraft hydraulic systems.

"BLAZES" is not the word—but suggests the rotor's shorter expression for the race at which the rotor spins. Fact is, spins are so high that the smoothness of the casting is important in terms of safety as well as serviceability.

So radiography goes to work and plays its unique part. With no damage to the product, radiography looks inside the part and checks each rotor's structure. Only flawless parts will meet the strict requirements of service.

Proving soundness with x-rays has become commonplace practice with more and more suppliers of quality castings. They know it helps build reputations for delivering only good work.

If you'd like details on how radiography can improve your operations, get in touch with your x-ray dealer—or write us for a free copy of "Radiography at a Foundry Tail."

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A ROUGH RIDE FOR THE ELECTRONIC UNIT!

So DOELCAM makes sure it rides safely with NOPCO LOCKFOAM

When you're building a guided missile, you have to find a way to protect from terrific vibration and shock the sensitive sensors, capacitors, vacuum tubes, and transistors that make up the electronic "brain" of the smart projectile.

Let Doelcam Corporation, Boston, Mass., tell you why they chose Nopco Lockfoam for this important task. Says Doelcam: "The electronic parts, firmly housed in this lightweight plastic, withstand tests of vibration at 3 planes from 0 to 500 cycles per second at 10 G and shocks of 50 G. The advantages of Lockfoam in such electronic defense applications are its light weight, inherent strength, and its ability to grip the electronic components firmly enough to protect them from vibration and shock and yet gently enough not to crush them."

Plus, of course, ease of assembly: the Liquid Lockfoam is simply poured into a mold which contains the electronic circuit and hardens around it.

Each of Lockfoam's 50 different formulations is highly consistent and reproducible. Perhaps the sure combination of properties of this versatile plastic can help with some product you have in mind. Write today for the Nopco Lockfoam booklet.

Nopco Chemical Co., Plastics Division,
100 Selig St., Harrison, N. J.

NOPCO

California Office: 4215 Wilby Blvd., Los Angeles 32

avoid greater vulnerability of titanium alloys, and now we add that it must meet development of better and less expensive alloys, a steep recovery process, and faster production methods which produce less scrap."

► **Use Prepack**—During the period when titanium alloy bolts are available at considerably high costs but titanium alloy nuts are not, high-strength aluminum and silver-plated stainless steel nuts are substitution substitutes.

For the lower temperature applications it seems doubtful at this time whether aluminum nuts will ever come up to the weight saving potential of aluminum at comparable costs and strength levels.

Doelcam proposes consideration of weight-saving progress built around titanium bolts with aluminum and stainless steel nuts. The average bolt weight saving should be about 30%. For the lower temperature, a high-strength aluminum nut should save 70%, or approximately another 30% of total fastener weight. This combination, therefore, would reduce weight about 70%, he says.

In the high-temperature category, a combination of titanium bolt and 12-point stainless steel nut should give about a 40% weight saving.

A high-strength aluminum nut is available capable of meeting the same tensile strength requirements as the steel or titanium nut it replaces. It weighs 1,000 lb per cubic inch—compared to 2,100 lb, compared to 2,800 lb for steel. The steel nut, one pound of weight saved with a titanium nut was found to be 5300 minimum with aluminum; the cost of a titanium nut saving would be 60 cents per pound, Doelcam says.

"These aluminum nuts have demonstrated compatibility with titanium alloys," he says. "They have already been used with titanium bolts by three major defense manufacturers, and out of these has gathered considerable production assembly experience. Naturally this combination is restricted to direct hand applications where temperature is not a serious factor. This includes between 90 and 95% of all fastening applications in current and projected aircraft aircraft."

These aluminum nuts, meeting AN specifications for steel nuts of the same sized size, are made in sizes up to 1 in. Above this size, Doelcam suggests aluminum nuts with an ultimate strength of 90,000 psi instead of the 140,000 psi required of equivalent steel nuts. "We believe the 90,000 psi figure to be entirely satisfactory for the short applications which comprise 90 to 95% of all turbine bolted connections," Doelcam says.

The high-temperature applications and where the steel is in tension, he says, a weight decrease from percent possible can be obtained through use of 12-point nuts. These would be silver-plated stainless steel nuts, compatible with titanium bolts since the plating appears to be sufficiently durable to prevent plating buildup and galling on the bolt or nut threads. A weight saving of 40% can be obtained through the combination of titanium bolts and silver-plated stainless steel 12-point locknuts, as compared to steel bolts with steel hex nuts.

"Our own and aircraft industry tests show these aluminum and stainless steel nuts to have satisfactory fatigue behavior characteristics in both steel and titanium bolts," Doelcam concludes.

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MINIATURE PRECISION POTENTIOMETER



This extremely low output potentiometer requires virtually no torque which permits a degree of accuracy in both linear and non-linear functions not normally encountered in ordinary potentiometers. The extremely low output for minimum working load means provide low contact resistance and mean travel and have an extremely long service life.

SPECIFICATIONS, MODEL 36,000:

- 5" x 3"
- Resolution: 200, 250 to 1000 ohms in positive range, up to 100,000 ohms in zero range.
- Characteristics: only with constant impedance.
- Accuracy: linear $\pm 0.1\%$, after load time $\pm 0.1\%$, typical for the load.
- Resolution: linear up to 1000, repeated over resistance and tolerance.
- Reliability: mechanical resistance: electrical 200, 250 to 1000 ohms, product of load spring constant.
- Temperature: linear $\pm 0.1\%$ to $\pm 0.1\%$, for 1 gpm, 10 in. as for load tolerance.
- Resistance: 200 to 100,000 ohms, all in or for each individual.
- Weight: 1.5 oz. for 1 gpm, 10 in. for each individual.
- Environmental conditions: temperature $\pm 0.1\%$ to $\pm 0.1\%$, for resistance in per ohm; and water in specific oil checked help, due to a unique heat dissipating design, 100 to 1000 ohms per ohm.
- Material: 100 ohms to 100 gpm.

Recommendations: regarding specifications are available for consultation at 1000 ohms, without obligation.

CYBROMEC

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11400 Whitely Road, Los Angeles 20, California
Design and production of precision potentiometers, give direct response, and magnetic amplifiers.



Air Force Honors Small Business Chief

Kenneth Wolfelt, chief of the Air Force Office of Small Business Development, receives a commendation for extraordinary performance in conducting that organization's program of bringing small firms into the defense picture.

Presenting the commendation is Brig. Gen. T. P. Gentry, Air Force director of procurement and production expansion (right). Warranting commendation, Lt. Gen. R. L. Boudier, deputy chief of staff, assisted.

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- Probably the outstanding characteristic of Twin Coach Aircraft Division plants is the wide aircraft experience of its personnel. This experience extends to all levels of the organization—from executive ... through supervisors ... to production.

This means that prime contractors can expect top-quality design and construction to Twin ... can rely on Twin's producing assemblies to specification, in quantity, at low cost. Modern facilities, modern equipment and experienced manpower make Twin Coach a dependable source for every type of major aircraft assembly.



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4. John Lee 33 years
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6. Henry Schaefer 33 years



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Aircraft Division

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PRODUCTION BRIEFING

►Control Systems Division, Fairchild Engine & Airplane Corp., has expanded its authorized product department by losing a new plant in Cambridge, N. Y. Fairchild will make master parts, client find articles and special shipping containers. ... Fairchild's Systems Division has purchased military rights to a number of patents: controls and valves developed jointly by the company and Kendall Controls, Corp., Wilkes-Barre, N.Y., an addition to some Kendall line patents and specific controls and valves.

►Aircraft Engine Division, Ford Motor Co., Dearborn, Ill., plans to build four more jet test cells costing slightly over \$1.5 million for production tests on J57 engines. First new test cells will, two for engineering tests.

►Surplus military property disposal is becoming a big business for the Protonics Information Center, Old Post Office Building, Washington 25, D. C. Center handles data covering excess property of all three services.



AUTOMATIC EJECTION of pilot's seat out by hole area, saving the operator 20 sec. in ejection out, the pocket bag material after each test, is simply handled by wrapping a 14-in. length of steel wire around the 4-in. wire pilot. The two lines are pulled tight to secure the wire on the pilot, then the rest of the wire is bent into a hook and over the spring. The spring compresses in the wire when it is cut. When the cut is complete, spring pressure pulls the clip out. The clip belongs to plastic tube color Frank P. Rice, Jr., Vaco Aircraft Corp., Dallas.

►Accessory Products Corp., maker of pressure regulators, valves, filters and related equipment, has opened an additional plant in Wichita, Kan., plant adding about 9,000 sq. ft. to existing area.

►Dallas Aircraft, Inc., Tex., has received a large USAF engine overhaul contract including work on some PW-4A B1830 engines, covering an eight-month period. With the new

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Lockheed Increases Thermodynamics Staff

With six prototypes now in flight, Lockheed's Thermodynamics Department is expanding its staff to handle greatly increased research and development on future aircraft in commercial and military fields.

Lockheed's new icing tunnel, designed and installed to help handle the increased work load, is already in operation. It is the first icing tunnel in private industry, and gives Lockheed's Thermodynamics Department an attached engine facilities.

The tunnel enables Lockheed thermodynamics scientists to study in greater detail such problems as: thermal anti-icing, cyclic de-icing, various methods of ice removal, distribution of ice, rate of temperature changes in aircraft components, thermodynamic correlation between laboratory and flight testing, and development and calibration of special instrumentation.

Thermodynamics Center Opportunities—A number of new positions have been created by Lockheed's diversified expansion program. Thermodynamics assignments include such diverse projects as nuclear energy, supersonic fighters, missiles and transports, advanced versions of nuclear ring aircraft and bombers, turbo-prop transports and a number of excellent classified projects.

Lockhead offers you increased salary rates now as effort, anxious travel and moving allowances, an opportunity to enjoy Southern California life, and an extremely wide range of employee benefits which add approximately 14% to each engineer's salary at the time of insurance, retirement provision. Ask, here with pay, etc.

[illegible]

The following contract awards were recently announced by the Directorate of Procurement and Production, Ogden Air Materiel Area, Hill AFB, Utah.

Commonwealth Electric Co., 1260 Y St.
P.O. Box 1007, Lincoln Neb., Installation of
wiring. \$14,110

Waxton H. Bruckner, Ltd., 10735 Northridge
Blvd., N. Hollywood, Calif. makes a pure perfume
for 50¢. *Waxton H. Bruckner, Ltd., 10735 Northridge*

The following contract awards were recently announced by Oklahoma City Air Materiel Area, Tinker AFB, Oklahoma:

General Electric Co., 1 River Rd., Schenectady 5, N. Y., tubes and dynodes approx. 100

General Motors Corp., Warren, Mich., has developed a new 4400 cc. V-6 engine, which is expected to be available in 1970.

Waters, Inc., 1620 Columbia Blvd., Detroit 27, Tel. 462-6600, 128 ea., \$14,100.

Boeing Aircraft Co., Inc., 1961 B. Manual.
 Part 1, Series 7000, 1962. Single model
 edition of B-47 aircraft 41-42, 4700-44.

Services Div., Fairchild Engine and Airplane Corp., Map Drive 1, L. I. E. modification of this existing type, 1951-52, 17-1000, 1000.

Forbes, Chevrolet Engine Co., 118 Queen St.,
Baltimore, Pa. Also, various, Baltimore, Pa.

ABDC Controls

ARDC Contracts

The following contracts have been announced recently by Headquarters, Air Research and Development Command, Baltimore 1, Md.

AMERICAN INSTITUTE FOR RESEARCH, INC., 60 Amsterdam Ave., Fifth Avenue 10 research and reports on the development of a comprehensive psychological test battery for use in longitudinal studies of age-related changes in individual personality and psychomotor abilities (F.R. No. D-68115, 1968).

ARTHUR H. EINHARDT, FREDERICKSON of
Office of Technology, Technology Center,
Chicago II, research and reports on the
physiological effects of noise (JFL 26
100-145, 146-154)
J. Acoust. Soc. Am. 44: 145-154, 1968

development of theoretical methods of separation and analysis for organochlorine amounts of trace amounts (P. G. Mo, 1994/95, 823-150).

WILKINSON ENGINE INC., 1415 Main Street, Chicago, Ill., is listed in Air Force Research and Development Contracting Office's handbook, 80814.

COUNTESS D. FERRIS, of Harvey Pl.
 Division, N. F. Division of Highway
 on Highway (1914, 1915, 1916, 1917, 1918, 1919, 1920, 1921, 1922, 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933, 1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590,

WINTERBURNER ELECTRIC CORP., 811
66, Ford St., Baltimore, supply of air vehicle

PROSECUTOR GENERAL, 100 West Ave.
and Avenue B, Brooklyn 25, N. Y., received
and reports on "Blackmailing of Thomas
Dawson" (CH 30, 100, 110, 120).

RYAN HAYES COLLIER: Ryan Hayes is a research staff member on "Influence of Environmental Factors Pertaining to Air Force Operations on Environment in Defense."

[P.R. No. 202144]. 271-48



Accessory Products Corp. designs simple sink purging regulator to help solve complex fuel problem

See next page >

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Stable, safe fuel tank pressure maintained by APCO's light-weight regulator

Often the most simple component designs are the result of greatest study and research by the supplier. Typical of Accessory Products Corporation regulator engineering ability is the simple fuel tank purging regulator produced for the Douglas Aircraft B3-66 jet bomber.

► Douglas actually required an automatic pressure regulator for fuel tank purging that would allow 28 pounds per square foot per minute to psi tank pressure, plus or minus 16 psi. Inlet pressure between 5 and 25 psi were to be supplied with ambient temperature between -65°F and $+155^{\circ}\text{F}$. The line flow temperature range was from -55°F to $+200^{\circ}\text{F}$.

► Naturally a nonflaring type regulator would be employed for such close safety work, but APCO engineering developed a rugged compact off-on regulator with a slow actuating flapper valve that enables constant pressure control regardless of air/cake acceleration. All qualifications were met without exception as required by USAF MIL-E-5272 as well as Douglas Aircraft requirements. (See performance curve.)



Performance curve of APCO tank purging regulator shows ability to handle commonly large volume with minimum pressure drop.



Note the almost straight flow passage.

Alert young men with young ideas head APCO depts.

Forever striving for simplicity along with top product performance, APCO's engineering department has become widely recognized in the industry for its unusual solutions to the fluid flow and pressure problems created by high speeds and altitudes. Bill is a part of the young, progressive-minded specialists, team extra teams, to be found in Accessory Products Corporation.



Meet APCO's Chief Engineer, Bill Stark.

Douglas praises APCO design ability

"Our experience with Accessory Products has been most gratifying," says Cliff Mann, Chief Power Plant Engineer, Douglas Aircraft, Long Beach. "Their exceptional design ability and extra application to the problem has made them very well qualified for our tank purging regulator job as well as the many other contracts they've fulfilled for us."

APCO invites your complex pressure regulator problems

Accessory Products Engineering is particularly interested in regulator problems calling for unusual design ability. If you cannot solve your APCO Sales Engineers to discuss your pressure regulator or valve problems.



An APCO tank purging regulator is shown being exhibited by Walter Chen, chief test engineer.

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APCO has designed and manufactured hundreds of different aircraft pressure regulators, valves and filters and allied components. Send for our free catalog covering many of our developments.

Rigid quality control applied to each regulator

APCO's extra rigid tests of the operating characteristics of every unit is your guarantee of quality. Customer requirements are checked and rechecked at the test

stations to detect any malfunctioning of the unit. Additional safety factors are designed into every APCO product test and check those required by the customer.

APCO

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New

M-R-C SUPER-PRECISION Instrument Ball Bearing CATALOG



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Executive Offices: Jamestown, N.Y.

WHO'S WHERE

(Continued from p. 13)
V. H. McKeade has been appointed manufacturing manager for Wallace Aviation Corp., Wallingford, Conn.

Charles K. Blaney has become manager sales director for Northwest Aircraft Sales. Also promoted are Jack A. Kellie, to manager of agency and service sales; David D. Clery, to assistant manager, agency and service sales.

Charles A. Roney has been promoted to new products manager for Berry Corp., Waltham, Mass.

A. W. Mangan is now assistant manager operations for Corbin's Bay Dugout Division. Other changes: George A. Doughton, assistant to the manager, Ray H. Giddens, quality control manager.

J. M. Fries has become domestic sales manager for Canadian Foster Aircraft.

Edward J. Nelson has been appointed regional sales manager for the Local Division of Lear Inc.; James Martin, Chief Ralph K. Lefebvre is now assistant in the commercial sales manager.

Robert Keener has been named advertising and sales promotion manager for Delmar Manufacturing Co., West Des Moines, Iowa.

Alfred M. Hobbes, former executive of Colonial Airlines, is now assistant to the president of Paines Hall and Cottage Colonies of Bermuda.

S. W. Vanden, manager of Customs Engineering office in London, now has assumed control of the firm's office in Washington, D. C.

Arthur L. Shultz has become director of technical and agency sales for Western Air Lines.

Edward J. Murphy is now passenger sales manager in the New York region for KLM Royal Dutch Airlines.

Mark L. Corbett has been named public relations director for San Francisco International Airport, replacing the late Edward Korman.

James Evans, chief merchandise for Sales America Co., San Jose, will organize the 1955 International Challenge from the International Friendly Companies next June in London.

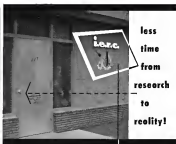
Ray B. Johnson, chief sales engineer for Washburn Aircraft Inc., Hawthorne, Calif., has been elected president of the Veterans of Safety.

Edward E. Taylor, general sales and aviation sales, has been awarded a "Diploma of Honor" by the International League of Aviation.

Edmund W. Collins has become assistant to the president of National Co., Malden, Mass.

Dr. Theodore Thordarson, former assistant for Air Research and Development Command, has joined Fairchild Engine & Airplane Corp.'s Engine Division, Farmingdale, N. Y., as a consultant.

Ruben C. Hale, executive editor of Aircraft and Air Currents, former technical editor of Aviation Maintenance and Operation and now security associate editor of Flight World, has been appointed director of publications for Aerospace Society of Registered Engineers, New York.



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research design development prototypes manufacturing



PILOT GETS MORE INFORMATION from Integrated Instrument System, which incorporates three new basic flight instruments.

New Sperry System Eases Pilot's Job

By Philip Klein

The new Sperry "Integrated Instrument System" which displays on three instruments the information regarding fuel or more on many of today's aircraft, shows considerable evidence of attention to human engineering principles. The three new instruments also incorporate associated controls now scattered around the cockpit panel and console.

The new IIS includes a redesigned Zero Reader complex, using an vacuum tube, which reportedly provides much improved IIS appearance. In view of new beam coupling techniques, the system is designed also for easy integration with the Sperry A-12 autopilot, to eliminate duplicate gyro and compasses.

The American World Avionics has added dual installations of the new Sperry system for its first of DC-7Cs (Aviation Week, Nov. 21, 1954, p. 14).

The following—these are a few examples of how the new IIS is designed to ease the pilot's job in IFR weather:

- Combined Zero Reader and horizon

indicator, employing newest type of spherical attitude presentation, enables pilot simultaneously to view own position instruments (by reference, by left/right) as well as plane's path and bank angle, without shifting his eyes to a separate horizon indicator.

- **Pictorial presentation of plane's position** relative to IIS indicator or VOR beam uses a V-shaped pointer which, centrally, shows whether pilot is headed toward or away from station, element used for a separate "to-from" indicator on the instrument.

- **Schmitt switches** located on new radio magnetic indicator enable pilot to select either VOR, ADF, or one of two types of station bearing for display on the RMI pointer with less chance of his becoming confused as to which position are indicating what.

Despite the multiplicity of information displayed, all instruments are in standard 14-in. diameter case sizes.

- **Horizontal Zero Reader**—The new Sperry HZ-R indicator is an answer to the old error that a flight director instrument tells him only what to do, shows nothing about the all-important airplane pitch and bank angles.

On the HZ-R, the plane's pitch and bank angles are shown by a spherical ball behind the Zero Reader cross pointers. The ball is visible colored to indicate whether plane is in a pitch-up or down attitude, and graduated scales show the extent of the pitch and bank angles.

The horizon ball is seen driven about the pitch and bank axes from a remote, (radio panel) non-handling switch point.

- **Pictorial Deviation Indicator**—The new Sperry R-1 pictorial deviation indicator has wide resemblance to the long-used ILS cone-pointer indicator which it replaces. The new R-1, like the cone indicator made by Collins Radio, goes at the pilot's personal presentation of his plane's heading relative to magnetic north and position relative to the VOR or ILS heading beam. The new R-1 differs from the Collins instrument in the following respects:

- **V-shaped pointer** is used instead of a single VOR/ILS heading pointer illuminating the needle for a separate instrument on the instrument to show whether plane is flying toward or away from the station.

- **Desired VOR radial** bearing set into the R-1 appears in digital form on a Vocoder-type counter, instead of as a pointer against a compass rose as on the Collins unit.

- **ILS glide slope pointer** is included in the Sperry R-1. Collins puts this pointer on its approach bearing instrument instead of as its course indicator. When the R-1 is being used for course-only navigation flight, the horizontal glide slope pointer disappears all scale.

- **No magnetic heading** is displayed on the Sperry deviation indicator, unlike the Collins course indicator, because this information is presented on the Sperry RMI. However, the inner mechanism of both the Sperry and Collins instruments are devised to mag- netic heading so that they rotate as the plane changes heading to display the correct angle continuously between airplane heading and the radio beam.

In the R-1, the inner mechanism rotates 180 deg. when the plane passes over the VOR station, giving a reversal of the V-shaped beam pointer. By dropping a small lever on the R-1, the pilot can switch readily to a reversal of the VOR heading pointer, so that it is without changing the "desired" beam deviation.

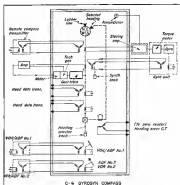
- **No Flight Director, Roll**—The pictorial deviation indicator is not a compass. Roll-deviation free of instruments the heading is furnished by the HZ-R bearing indicator. However, Sperry notes that a pilot may approach a VOR or ILS beam inadvertently (without heading) if the end of the V-shaped needle is kept aligned with the horizontal axis (the center line).

By reference to roll two instruments, the pictorial deviation indicator and heading indicator display, the pilot has the roll-center by left-right reference. His plane's pitch and bank attitude, his position relative to the VOR/ILS heading and glide slope beams.

- **Green Radio Compass**—In recent years, the new Model C-6 Gyrocompass, a conventional RMI, cannot be the better control to select either VOR or ADF for pointer display. However, says a Sperry engineer, should provide more accurate magnetic heading information because of the need now to which it is stored to the compass.

In a conventional RMI, the heading rate is servo-driven from a single provided by a resolver on the directional gyro, which in turn is driven to the remote compass. In the new C-6 the heading indicator is in effect directly driven by the remote transmitter, eliminating one link, and one source of error, in the chain (see diagram, above).

However, the C-6 heading indicator



MORE ACCURATE HEADING information results from using C-6 RMI that directly in remote compass element while still using gyro's direction-inducing effect.

is also tied into a remote DG as in to provide short-term stability in present compassing events caused by using a turn from being selected into the indicator the pilot uses.

The C-6 also has a course center which the pilot can set to the magnetic heading he wants to fly. This unit provides a small reference on the C-6, and simultaneously sets in the sense of turn heading into the flight director. • **Better IIS Appearance**—In redesigning the IIS with the A-12 autopilot, Sperry achieves several interesting advantages.

For example, one vertical gyro otherwise required for pure attitude information is eliminated. At the same time, the system is rigid so that failure of the vertical or directional gyro need for pure indicators does not necessitate the IIS. The pure instruments may be switched to the gyro used in the A-12, providing a complete set of attitude gyros.

- **Weight & Size Comparison**—A direct read and weight comparison of the new IIS and the older Zero Reader is difficult. The new IIS performs many more functions and replaces some existing instruments. However, due to reduction of IIS can be substituted for Zero Reader, an A-12 equipped

legs set up by the instrument process, Sperry also introduces angular position to bank angle, which is frequently equivalent to rate-of-change of attitude displacement.

In the glide slope channel, the compass can be displaced and rate of change of attitude, without reference to pitch attitude, except to get a rate-of-change of pitch angle signal to compensate for loss due to bank rate maneuvering.

• **Integration Advantage**—In redesigning the IIS with the A-12 autopilot, Sperry achieves several interesting advantages.

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- **Weight & Size Comparison**—A direct read and weight comparison of the new IIS and the older Zero Reader is difficult. The new IIS performs many more functions and replaces some existing instruments. However, due to reduction of IIS can be substituted for Zero Reader, an A-12 equipped

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Westinghouse J34's—podded and slung under the wings—give the U. S. Navy "Nagano" extra speed and reduce the take-off run. On missions, they can give the craft margin of power to get on target faster and away quicker. Drag is less and performance even better than subsonic.

The record of the J34 shows it well fitted for such auxiliary use. It has been proved in tough operational service; has achieved a 720-hour overhaul life; performed up to 56,000 feet; withstood seven battle damages; and is quick to install and easy to maintain. The J34 history shows progressive design changes and performance improvements to its present highly developed state giving the best specific fuel and weight characteristics available in its class.

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Tomorrow's Aircraft Brings Cities One Step Closer. The dotted line shows how J34 pods can help aircraft reach optimum altitude faster, maintain more efficient engine control, and retain extra margin of economy in time and distance. En route time can be drastically reduced; for example, the Los Angeles to New York run which might be cut as much as 25%. J34 auxiliary can give these advantages to aircraft currently in use or planned for future requirements.

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400 cps. to 70 kc., and frequency response is flat within 3 db from d.c. to 100 kc. Total harmonic distortion at 125 kc. distortion is 2%, according to manufacturer. Frequency drift is within 0.075% over temperature range of -3C to 70C, less than 0.1% from sea level to 60,000 ft.

The same manufacturer has announced a new 81 gm. goniometer, Type 565C, rated 75.25 watts from a 1 to 1-w. drive, has a 150-hz. resonant bandwidth over frequency range of 215 to 235 mc.

After temperature stabilization, output variation will not exceed 1% db. over temperature range of -50C to 100C, or at altitudes ranging up to 70,000 ft.

Address: Ruxton Room Engineering Products, Inc., 32nd and Walnut Streets, Philadelphia 4, Pa.

Other new instrumentation devices include:

• **Self-cure goniometer**, Model F-450, weighing only 6 oz., has selective gain of 16, 30 and 100, and frequency response of 5 to 70,000 cps. The built-in device includes a cathode follower to give a 100 megohm input impedance. Unit measures approximately 2 1/2 x 1 1/2 x 3 1/2 in.

Manufacturer: Galton Mfg. Corp., Metuchen, N. J.

• **RF power amplifier**, available in two models. Type REL-99 rated 18 watts from 115 to 215 mc., weighs only 12 oz. The REL-98, covering same frequency range, provides 15 watts weight 2 1/2 lb. Amplifiers are available from Rhine Research & Development Lab., 9216 E. 114th Road, Downey, Calif.

• **Remote** who is producing schematic instrumentation amplifier, RUT-12, with response flat to within 1% from 5 to 100,000 cps. Unit can be supplied with fixed or variable gain of 15, 100, and 500. Linearity is within 1%, input impedance is 1 to 30 megohms, and output impedance is under 175 ohms. Rhine says that the unit has been designed to operate in mobile or aircraft environments.

DEFENSE FILTER CENTER SEAS

• **New Helicopter Radar—Radio Avionics Pacific Division** reportedly is developing a lightweight airborne radar specifically for helicopter use, further strengthening its position in the engine control field. Radio-Pacific recently obtained 11 1/2 manufacturing and sales rights to the British Decca radar system (AVIATION WEEK Nov. 25, 1954, p. 17), previously announced, along with airborne radar, is likely before report made.

• **ANES: Taken Down View of Anstee?**—American Institute of Electrical Engineers would appear to have little faith in the future of aviation or the role of electronics in aviation, judging from the technical sessions scheduled for its annual winter convention in New York, Jan. 31-Feb. 4. Of 90 technical sessions scheduled, not a single one is devoted to aviation at all, although surface transportation carries two sessions and even telegraph systems after one. In contrast, Institute of Radio Engineers last year scheduled three full technical sessions for aviation.

• **Data Reduction Services—Lear**, Inc., has contracted with the Army to provide data collection services at White Sands Proving Grounds. Cook Research Labs. division of Cook Electric Co. will provide similar services and operate USAF's school tower at El Centro, Calif.

• **Less: What Hot Competition—Navy Radar** reportedly has selected Lear to produce low-drift, high-precision MA-1 directional gyro system after a fully controlled competition that involved a dozen gyro manufacturers. The Lear gyro, using fiberoptic rather than cut structural members, reportedly has a free gyro drift rate of 1 to 2 deg. Shaving amplifier will use breakdown and zero-curve amplifiers. —PK

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OVERSEAS SPOTLIGHT

Hawaii Base Plan Revised

Vietor Rasmussen's new Hawaiian plane receiving line-Hawaii Airline-bus withdrawn as request for an exclusive franchise as a fixed-base operator at Honolulu International Airport (Aviation Week Nov. 8, p. 35).

The action came after almost all the airlines using the airport expressed opposition to granting an exclusive franchise, although they expressed a willingness to use Hawaiian Airline as a feeder operation on an open competitive basis.

Rasmussen L. Rasmussen, vice president in charge of the company, said that "operations will start as soon as the new lease is signed." He said, however, that there would be a "considerable contingency" of the company's planes.

"Without the protection of an exclusive lease we will not be able to lose as many people as we had hoped, and we certainly will not be able to put up the large capital investment and equipment we had planned," he said. Rasmussen had planned an investment of about \$150,000 and expected to employ 230.

Saab Produces New Safrir

SAAB

Saab Aircraft Co. has shifted production of the Safrir 910C, a four-seat version of the company's single-engine 4-cylinder lightplane at its main plant in Linköping. The 910C can be used for exercise or pleasure travel, or as an air taxi or ambulance. As an ambulance, it has room for a stretcher and medical attention.

Saab-Linköping is also producing the Safrir 910B three-seat edition, and has

several pilot trainers. The Safrir is being used by pilot training operations in eight countries, says Saab.

Powers Clash in Austria

AVIA

The Soviet members of the Allied Council for Austria have vetoed a plan for an Austrian aerospace union to aid return of winter colonies. The veto charges the government's request for five lightplanes and five engines is a device to permit resumption of Austrian military activity, outlawed by the Allies in 1945.

The U. S. veto was that there was no secret understanding between Soviet and Austrian officials, yet fighting between them during an embargo and a trial.

Big Red Airfleet up North

BOEING

About 1,000 new Red aircraft are stationed at over 400 airports in the Soviet zone adjoining Scandinavia, according to reports from the newspaper *Morgensposten*.

Capacity of these bases is given as 15,000 planes.

Fog Fighter in Production

BOEING

Boeing's Division of Defense has started mass production of its fog-fighting airplane for airports. Based on the T-10, the fighter, the Division uses methanol gas instead of liquid fuels for better visibility and better fuel economy.

The company claims that a landing made with the Defense fighter costs one-third our costs with F-4s. It is expected that later developments will bring the cost still lower.



New Stores Ejector Overcomes Mach 1 Speeds

North American P-51 Mustang Super Sabre is one of several lightplanes for F-4s at fighters equipped with new Boeing-McCoy Co. dual ejector seats for safety during high-speed maneuvers. The seats are ejected from the cockpit at Mach 1 speeds. The seats are ejected from the cockpit at Mach 1 speeds. The seats are ejected from the cockpit at Mach 1 speeds.

The new ejector seats are one of the most important developments in fighter aircraft. The seats are ejected from the cockpit at Mach 1 speeds. The seats are ejected from the cockpit at Mach 1 speeds. The seats are ejected from the cockpit at Mach 1 speeds.

BOLTS MAY LOOK ALIKE... But there is a Difference!



FLY HIGHER FASTER
— land refreshed!



One of the main reasons for the Scott mask is that it is a single mask for all types of aircraft. It is a single mask for all types of aircraft. It is a single mask for all types of aircraft.

NEW AVIATION PRODUCTS

Portable Kit Speeds Jet Hose Assembly

Complete jet aircraft hose assemblies can be produced on the spot in a few minutes using a portable kit packed in two carrying cases, the manufacturer asserts.

The kit has been developed specifically for field servicing of Mustangs, T-33s and can also be used on a few other jet engine and turbine motors.

The kit consists of a crimping tool, hydraulic pump, adapter bushings, manifolds, wiring, fittings and other items and simplifies engineering of new fuel, lubricant and monitoring and maintenance problems, the maker points out.

Resoliter Corp., Belleville, N. J.

Precision Unit Detects Jet Rotor Unbalance

(McGraw-Hill World News)

Stockholm—A balancing machine that can detect vibrations of 0.00001 in. amplitude in turbine compressor and turbine rotors is being produced by a Swedish concern. In addition to detecting unbalance in these components, the device also locates the angular position of the condition, either



SWEGRA machine for rotor inspection by referring to a scale or by optical means.

The manufacturer notes that the machine, designated YAR 30, is also useful for checking rotors of pumps and electric motors and fans.

Measurement is accomplished by suspending the rotor, up to 45 in. diameter, in two inductance bearings connected to vibration radiations and

carrying of a coil mounted in the shape of a permanent magnet. When an unbalanced rotor is rotated in the bearings at a constant speed, the bearings will vibrate, setting up sinusoidal alternating voltages proportional to the vibration.

Approximate price is \$5,700, Loh. Stockholm. U. S. representative of the firm is Lincon Corp., 100 Park Ave., N. Y. 17, N. Y.

Readout System Samples Up to 200 Pressures

Operation of aircraft instruments, cockpit and instrument engine test facilities, model houses and the like, where large numbers of pressures must be accurately measured and recorded simultaneously, are afforded a new multiple pressure readout system that can sample up to 200 pressures at one time with an accuracy of one part in 2,000 as high.

The device, called the Press-4-Cell Logger, also automatically converts pressure magnitudes into digital form for recording in a typewriter console log and as a punched tape.

Output can be fed directly to computers or read punch equipment without the intermediate tape storage of data, when the typed log is not needed. Random scale (from pressure sensing to typed log and punched tape) takes a little more than one minute and the

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Finally, vacuum-melted metals are so new that many applications for them have not yet been explored. But where they have been used, they've proved their effectiveness in improved performance. Superalloy jet engine turbine blades, for example, have given more than twice the performance life of blades made of conventional air-melted alloys. And ball bearing rejects dropped from 60% to 3% when vacuum melted steels were used.

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Now, Vacuum Metals Corporation, pioneer in the development and production of vacuum-melted and cast alloys, is producing tool, high-speed, stainless and alloy steels — in most sizes and grades — as well as special ferrous and nonferrous alloys. If you have a metals problem that vacuum-melted alloys might solve, please describe it in as much detail as possible. Write Vacuum Metals Corporation, P. O. Box 577, Syracuse 1, N. Y.



VACUUM METALS CORPORATION

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New Approach to Transport Loading

This interesting proposal for an airplane access program loading ramp shows how two sections of the ramp can slide in opposite built-in moving planes. Based upon sections from walkways over the passenger to protect them from the weather in their

entry plane. When lowered, sections become part of the airport loading ramp. Passenger facilities include two moving stairways. One, a horizontal conveyor, takes passengers from waiting area (lower left) in a stairway which passengers can be loaded

the airplane ahead of the wing. Deploying passenger ramp simultaneously take a moving stairway from the aft end of the plane. The artist's conception, using the Boeing 707 as a model, was originated by Eric Olsson, drawing is by J. MacKillop.



Now "D" Series jets are in use today that all other types of J47 interceptors combined.

Why the F-86D Sabre Jet Interceptor Now Climbs UPSTAIRS.... 20% FASTER!

**New production model J47-G8-33 jet engine packs more thrust,
also improves "D" reliability and ease-of-maintenance**

For the past three years, North American Aviation's F-86D Sabre Jet has been the fastest interceptor in the Air Force's Air Defense Command (top speed) over 600 mph.)

Today a new General Electric turbine, the J47-G8-33, is being installed in "D" Sabres. The engine makes the "D" still faster... more reliable... easier to maintain.

The J47-G8-33 has the same basic design as its predecessor, the J47-G8-13. But these six improvements reduce its weight, increase its durability, and, most important, allow it to swallow more air and increase its afterburner power:

1. New inlet guide vanes

2. New capacitor discharge engine ignition system
3. New "floating" turbine wheel shaft shroud
4. New Holmatric afterburner ignition system
5. New ceramic mass-flow air thermometer
6. New larger variable area jet nozzle

The J47-G8-33 can push 50% off the time originally required to "scramble" on F-86D from standing start to 45,000 feet.

By helping the Air Force reduce maintenance time and costs, as well as increase jet performance, the J47-G8-33 again illustrates the G-E slogan, "Progress is our most important product." Series 33A-3, General Electric Co., Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL  ELECTRIC



NEW INLET GUIDE VANES allow more air to enter compressor of J47-G8-33 engine. New vanes have cone configuration as first used on J47-G8-13, but pay off in increased thrust during dry and afterburner operation.



IMPROVED TURBINE in the J47-G8-33 engine is shielded by the new "floating" thin shroud visible above. It reduces the possibility of shroud ring run-on turbine wheel failure. G-E lock cap is pointing to new adjustable turbine bellows.

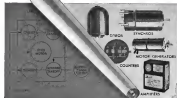


NOW, LARGER "STYLISH" handles increased J47-G8-33 wet flow just made V4, a sturdy ceramic coated liner sets on a retractor block, allows higher afterburner fuel flow when increases boundary layer cooling of the turbine.



CARRY J47-G8-33 QUALITY CONTROL as G-E manufacturing plants is already paying dividends to the Air Force. For example, only one out of four J47-G8-13's now require two tests before shipment to the USAF.

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equipment is then actually made to begin the test cycle. Shorter product cycles are possible, the manufacturer states.

Fischer & Porter Co., 269 Jackson Rd., Hoboken, N. J.



Unitube System is selected.

Unitube System Speeds Jig Fixture Building

The photos above and below show a comparison to the Wharton Universal Jig and Fixture System that has been awarded in the American market. The new production aid is the Unitube System. It is marketed by Wharton and Willocks of America, Inc.

Developed for such operations as welding, assembly and pipe cutting fixtures, it can be used for drilling and large machinery jigs. The company claims that there is no limit to the size of structure that may be erected nor to the work they are designed for. It is claimed that tools for welding procedures, for instance, may be positioned as two to four hours instead of 40 to 60 hours. The parts may be dismantled when the production run is completed, and later used again in different combinations.

Unitube consists of high-tensile octagonal tubing drawn to finished tolerances. Octagonal shape is used to give definite location to attached parts and eliminate slippage. The horns in the elements are also octagonal.

Basic Unitube set consists of 32 elements and 100 ft. of octagonal tubing. The company claims that cost of Unitube system is recovered in the first



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This study was conducted by Advertising Research Foundation, because of its industry-wide importance, on behalf of some 100 leading advertisers, agencies and media—including the American Association of Advertising Agencies and the Association of National Advertisers—which supports the Foundation's membership. Findings were derived through methods developed and used by ARF during five years of experimental research and used in actual studies of five other leading business publications. Because of these painstaking procedures and their absolute freedom from bias, Advertising Research Foundation studies are considered to be the most valuable research on magazine readership available today.

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*Paid circulation of the issue studied by ARF (April 5, 1984) was 47,375. Paid circulation of current issues exceeds 50,000. That means each delivery reaches more than 39,000 readers who really read!

of total circulation after 35 to 38 sub-
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Company's address: 17 Battery Pl.,
New York 6, N.Y.



STAINLESS steel valve assembly flush

Small Valve Drains Water From Aircraft Fuel Tank

A new valve, designed for rapid draining of water from aircraft fuel tanks, has been developed by Steel Products Engineering Co.

Valve is self-closing, is positive in operation and runs a replaceable O ring. It mounts flush with the wing's surface and its thin flange is built to withstand constant superpressures. It is made of stainless steel. Diameter is 2 1/2 in., length is 14 in.

Address: Springfield, O.

ALSO ON THE MARKET

Wire stripper works to within 1/8 in. of component and is adaptable to run on both manual or electric coils. Feed of wire is controlled in device and with down, three on or pull on lever to operate. Model L-1 costs \$100 (ask Syracuse, N.Y. or 511 for one month trial—Eaton Co., Inc., 1665 S. Clinton St., Syracuse, N.Y.).

Lightweight safety belt features a flexible ribbed to be 27 1/2" lighter than current types, having a special core which maintains holding strength, yet giving easy wear and being extremely reliable—Bever-Line, Inc., 341 North Euclid Blvd., Beverly Hills, Calif.

Non-hot-trustable electrode for steel parts subjected to high heat—vacuum and atmosphere, can be work hardened to over 180,000 psi tensile strength. Breakdown is 200 (ask) Despatchers All-State No. 273 (choose award) (order). Available in 1/8 in., 3/8 in., 1/2 in. and 5/8 in. (ask) Despatchers All-State No. 273 (choose award) (order). 1700 E. 1st Ave., White Plains, N.Y.

Hand-held milling machine combines a conventional spindle and self-contained automatic dialing unit for adjustable cutting heads, permitting horizontal and vertical specific to be run separately and simultaneously—Kennedy & Tucker Corp., Milwaukee 14.



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AVIATION SAFETY

CAB Report on Continental Constair Accident Emphasizes . . .

Parts Catalog Not for Maintenance

THE ACCIDENT

At approximately 0640, Mar. 16, 1966, a Continental Air Lines Constair 340, N 96510, made an emergency wheel-up landing in a barren field about two and one-half miles northwest of the Midland Air Terminal, Midland, Tex. The accident occurred immediately following takeoff. There were no fatalities but seven injuries resulted to two of the eight passengers and seven others in several other passenger and the three crew members. The aircraft received major damage.

HISTORY OF THE FLIGHT

Continental Air Lines Flight 46 to Mar. 16, 1966, was a daily scheduled flight between El Paso, Tex., and Kansas City, Mo., with intermediate stops, one of which was Midland, Tex. The crew, assigned to El Paso for the entire operation, consisted of Capt. Herbert E. Frazier, First Officer Robert D. Ryan and Hostess Patricia A. Williams. The last officer reported on D/F (Inter-continental Flight) before flight plan according to company regulations although the weather conditions were known to be that over the area of flight altitude. The flight was dispatched by the company and following a mid-air collision inspection by the crew, the flight departed on schedule at 0610. Over the next segment, El Paso, Mo. was encountered and it occurred at Midland at 0721. This stop was for passenger changes only. Therefore, the crew remained on board and the aircraft, having apparently appeared not really, did not receive attention.

At 0721, El Paso, Mo. was cleared to Kansas City at 0721. At this time the aircraft cut off 910 gallons of fuel and was loaded to a gross weight of 36,315 lb., which was 30,075 lb. less than the maximum allowable. The load was properly distributed so that the center of gravity of the aircraft was within the approved limits. A pre-flight check was conducted according to Kansas City at which time the propellers, engines and instruments gave normal performance. A part of this check included moving the control surfaces free and clear and turning the wheel left and right in order to check the control system for freedom of movement and full travel.

At 0820 the flight was cleared for takeoff, which was made using normal takeoff power. Immediately after becoming airborne the crew noticed a slight vibration which was attributed to an unbalanced condition of the primary main landing gear wheels. Captain Frazier applied full power during the landing gear vibration to eliminate this vibration, however it not only continued but rapidly increased in severity.

The shock resulted in attitude of ap-

proximately 75 feet, the highest altitude, and was seen by the report boundary when the vibration stopped with a sudden jolt and the aircraft entered a nose-down attitude. The first officer immediately seeing the vibration period the engine and thrust control that when through applying back pressure to their respective control columns to keep the aircraft from plunging into the ground. The engines quickly reduced power, however, the nose-down pressure could not be completely overcome.

The first officer and rescue team resulted in an effort to return the aircraft to the ground, but the aircraft had an appreciable effect and during the last attempt the first officer control column moved to the right. The engine established a shallow left turn with the thought of returning to the airport and continued the turn about 45 degrees from the initial turn.

At 1000 degrees from the initial turn, the aircraft entered a steep climb and was approximately 100 feet above the ground. The first officer, seeing power and thrust to maintain flight resulted in an unbalanced nose-down pressure. The engine therefore, desired to make a wheel-up landing, straight ahead. Close to the ground the first officer closed the throttle and the captain pulled the electrical crash bar. Contact with the ground followed with the aircraft in a nose low attitude and at approximately 100 mph.

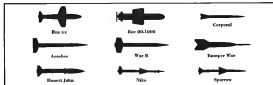
Although the passengers and crew remained in their seats during the crash, they were able to get out of the aircraft unscathed in an orderly manner. The evacuation was timely through the use of slides that (emergency exit) and was accomplished in about 30 seconds. There was no fire.

INVESTIGATION

The investigation established that the aircraft first encountered the ground in a nearly straight and level attitude on a magnetic heading of 15 degrees. While diving 1,700 feet the aircraft turned on its vertical axis and rolled over before coming to a stop on a magnetic heading of 310 degrees. The wing was cleared about a few feet to the landing gear. The wing was located approximately 200 feet beyond the final ground contact point on a severely damaged condition. The left engine was torn from its mount and was found beyond the left wing and behind the main portion of the aircraft. The left horizontal stabilizer was crushed upward at the aircraft panel was also crushed wing and remained attached only by the elevator hinge tube. The landing and right wing were buckled.

Examination of the right horizontal stabilizer and elevator revealed no structural damage; however, it was noted the right elevator brace was torn in a 24-degree or so around nose-down position.

There were control marks on the right wing based on the leading edge side of the rib at its hinge point. The stress down on



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the lower horizontal stabilizer surface was immediately opened to examine the trim tab actuating mechanism. This examination disclosed that the forward pushpull rod, which normally extends from the jack assembly forward to the elevator hinge-line slot, had failed. The driver assembly of the trim tab rod and the trim tab rod were welded against the bottom edge of the elevator support brace in such a manner as to hold the trim tab rigidly in a full-up position. The after showed no interference mark at the base of the hole in which the forward pushpull rod was attached and this mark matched a similar one on the failed pushpull rod.

The failure resulted from stresses around the inlet end bottom of the rod and compression at the top. Matching the fractured rods revealed a set of approximately one-eighth inch due to divergent bending before failure. All other components of the assembly were undamaged.

A comparison of the assembly, as installed, with the appropriate General Drawing disclosed both the after and the forward pushpull rod was installed in reverse. Interference between the after and pushpull rod was caused by the reversed after.

Closeup, measurement records showed the right elevator trim tab assembly had been secured, installed and inspected by emergency maintenance personnel. This work was done during a No. 3 check, 1440 Right

before going to the accident, for the purpose of ensuring positive play from the assembly. During the assembly and installation both the General Drawing Maintenance Manual and the Manufacturer's Illustrated Parts Catalog were used as references. Figure 7-411 of the Maintenance Manual, entitled "Elevator Tab Installation," was first referred to during the installation. This figure illustrated the after in a straight designed component whereas the actual part is curved, and depicted the forward and rear pushpull rods accurately in their inboard and outboard relationship. Dimensions 7-42 and 7-43 of the same publication referred to this figure for forward and rear installation purposes. From this figure 7-411, correct positioning of the after could not be determined.

In order to determine what was the correct after should have in the assembly the maintenance personnel involved made a reference Figure 285 of the Manufacturer's Illustrated Parts Catalog, entitled "Elevator Trim Tab After Installation."

This figure illustrated an exploded view of the complete left-hand elevator trim tab after assembly including its left after. Since the right after for the right elevator trim tab assembly was of different design than the left, it appeared above and below the left assembly but on the same plate. It was shown curved which correctly depicted its actual design. Thus, for a right-hand assembly it was necessary to substitute the right after in place of the left.

It was stated by the witness that by conventional interpretation of this drawing the left assembly would be correctly installed in the aircraft and the left after assembly installed in the assembly, however, upon substituting the right after as required for the right assembly and following the same conventional interpretation of the drawing, the result would be and was, a reversal

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After installation (the correct side forward instead of reversed).

Upon completion of the modification the customer told the supplier how he had installed the alloy. The supplier referred to Figure T-4181 of the Maintenance Manual and Figure 2005 of the Parts Catalog, the same references and in the meantime, and agreed with the customer's subsequent firm of the reference material. He then reported the work and thought it was satisfactory. The supplier was functionally tested in accordance with prescribed procedures and the results were correct. Subsequent tests revealed that the second side extension would be obtained with the alloy in reverse. But the check procedure required the alloy to be turned through its travel with the cylinder fairly, an extension would have been noted.

Figures 2-1184 of the Maintenance Manual, commonly called the "docking page" was not consulted during this installation or extension. It was stated by company personnel that agency was not involved and the firm did not include adequate installation and removal instructions. The figures have ever did illustrate correct positioning of the alloy.

During the public hearing it was stated by Company representatives that the Illustrated Parts Catalog should not have been used as a reference during the right cylinder trial-to installation. It was stated that the ground was solely published for the identification of parts and suggested repairs. It was also stated that a question involving installation, as in the case, should have been resolved by consulting the appropriate literature.

On the other hand, someone who was stated that someone earlier than the industry was to use the Maintenance Illustrated Parts Catalog as a guide, during maintenance work and they expected it to correctly describe the relative position of such in an install and in an assembly. Then, it was believed the Illustrated Parts Catalog was correctly used as an installation reference but because of the incorrect figure and its location at the right after it was installed in service. They further stated that Maintenance was not involved because maintenance work, even not suitable of existing aircraft where maintenance was not involved, was not involved, and it was questionable whether or not to involve maintenance and even could not be involved. Accordingly, for those reasons, someone earlier believed a Maintenance was not involved as a matter of performance in installation reference.

The Board, subsequent to the hearing, conducted a nationwide survey of approximately 75 maintenance bases owned and operated by military and civilian entities. Results indicated that approximately 65% of the operators did not consult the Maintenance Illustrated Parts Catalog as a maintenance reference and confirmed in use to be a source location of parts info. The survey also revealed that aircraft manufacturers with any exception do not insist that their Parts Catalog be used for any after repair.

Investigation disclosed the University of the assembly which was available at the time of the subject installation showed the right-hand view but was incorrectly

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labeled a difficult task. The idea was also designed a plan view, however, to be used in such, it was necessary to hold it covered or collapsed so it fit over in such a position.

Immediately after Bush investigation learned the cause of the failure in this new design an accelerated inspection program was conducted on all Corsair 340 aircraft. This was done in the interest of safety to insure that no other case in operation with the after gear. The manufacturer also took corrective actions to repair all portions of these aircraft of the factual situation as well as preventive action if necessary. As a result of the inspection which followed, reports revealed that four Corsair 340 or more were in service with several others. Two of them had no maintenance records relative to the assembly and were allowed to have been modified before installation. One other aircraft was found with a forward push pull rod bent indicating a forward air interference near this point in the inspection. The total time spent on these aircraft varied between 1,600 and 3,000 hours.

Complete maintenance and inspection records relative to the aircraft and engine disclosed no other discrepancies and apparently FAA directives had been complied with.

Investigation disclosed that all maintenance, inspection and flight personnel were currently certified for their respective duties by the Civil Aeronautics Administration.

ANALYSIS

Immediately after the aircraft became airborne the crew noted a vibration which became more severe as air speed increased. It was very noticeable that the vibration was due to the fuel filter which moved into the push pull rod and failed and the air flow over the fuel filter fell within increased to the extent



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ical failure speed for the free tub condition. As we speed built up, the conditions increased as anticipated until the stick out of the tub and became wedged, holding the free tub in a full-up or over-ride position.

The free tub position and the resulting over-ride position could not be overcome by the crew and necessitated the shutdown landing which followed. The failure of the push pull rod was caused by stress imposed on it as a result of the over-ride and other conditions.

As shown under investigation, the Maintenance Manual was first consulted during the stick elevator free tub condition and Figure 7-2181 of this manual was noted and the appropriate reference. Since the figure did not illustrate correct positioning of the cable, the wire was disconnected allowing its installation isolated, this part of the Maintenance Manual was adequate.

Although rigging was not continued to be watched by the mechanics and inspectors, it was clearly related to this condition. When the other installation question was referred to the inspector by the mechanic, his experience and responsibility should have prompted him to refer to the "rigging page" (Figure 7-2184 of the Maintenance Manual) in addition to the reference previously mentioned. Had he done so the inspector should have noticed that the wire was installed contrary to the rigging diagram, advising him to the maintenance of the reference.

The error is implied by Civil Air Regs. When to prepare and maintain a Maintenance Manual and it is responsible to determine that the manual is complete, correct and adequate. The Illustrated Parts Catalog is not considered a part of an aircraft, it is the Maintenance Manual. The Board therefore is of the opinion that the crew did not meet its responsibility to determine adequacy of its Maintenance Manual and its failure preventing the use of the Parts Catalog as a maintenance guide was critical.

The public hearing revealed that other crews have used the catalog in a maintenance guide. This practice indicates that in some instances the publication has been suitable for the purpose and leads to the conclusion that due to a mistake of the manufacturer in preparing Figure 7-2181 of the Parts Catalog, the cable wire was shown with an incorrect cable location, or an incorrect release in its correct installation. Although representatives of the manufacturer stated this publication was not intended to be used as a maintenance guide, it is evident the error was not aware of the publication's limited purpose.

As shown by the Board's safety survey, approximately one-third of the scheduled and unscheduled events have used Parts Catalog as maintenance reference although manufacturers have not prepared firms for this purpose. The Board believes that the publication, unless specified by the manufacturer, should not be used for maintenance purposes and as a result, the Civil Aeronautics Administration has taken measures which will clarify the conflicting opinions relative to the proper use and purpose of the Illustrated Parts Catalog, emphasizing that it is not considered a maintenance

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gain under Civil Air Regulation. The Board is of the opinion that this action taken by the Civil Aeronautics Administration is appropriate, however, the amount of the First Citation should have been noted earlier by the CAA through its assigned agents for more timely action.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The engine, the aircraft and the crew were properly maintained.
2. The aircraft was loaded to a weight less than its maximum allowable for takeoff and its center of gravity was located within the approved limits.
3. The postulated checks performed by Mollard indicated the engine, propeller, instruments and controls functioned normally.
4. Immediately following a normal takeoff the right elevator trim tab push pull rod failed and the tab end became wedged, holding the trim tab in a full-up in aircraft nose-down position.
5. The trim tab position resulted in the crew being unable to control the aircraft and a subsequent landing resulted.
6. The push pull rod failed as a result of excessive stresses caused by interference resulting from a reversed aileron installation.
7. The right elevator trim tab assembly was removed, inspected, assembled and functionally checked by company maintenance personnel 14-45 flight hours prior to the accident.
8. Correct positioning of the right aileron component could not be determined from the Maintenance Manual figure, 7-4-101, which the owner considered appropriate for the installation.
9. The Maintenance Illustrated Parts Catalog was used in accordance with company policy as an installation reference to determine the aileron position.
10. Under conventional interpretation of the appropriate exploded diagram of the Parts Catalog, the aileron was installed as reverse.
11. The Illustrated Parts Catalog was not intended and should not have been used as a maintenance reference.

POSSIBLE CAUSES

The Board determines that the probable cause of this accident was loss of control due to a failure of the right elevator trim tab push pull rod caused by a reversed installation of the right elevator trim tab aileron as a result of the owner's reliance on the Maintenance Illustrated Parts Catalog as a maintenance reference.

By the Civil Aeronautics Board:
Clara Conway
Donald Ryan
John Lee
Joseph P. Adams

(Homer D. Dwyer, Vice Chairman, did not participate in the adoption of this report.)

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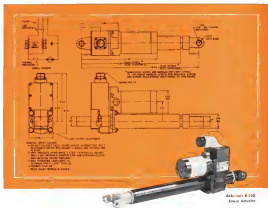
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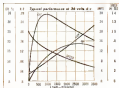
AVIATION WEEK, January 30, 1955

39



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AIR TRANSPORT

Mexico Shifts Policy, Plans N.Y. Route

- Government has given nod to CMA, country's largest airline, which is buying DC-7s for nonstop service.
- However, agreement with U. S. must come first; meanwhile, Air France skims cream off traffic.

(McGraw-Hill World News)

Mexico City—The Mexican government has decided to encourage use of its nation's airlines to undertake nonstop service to New York, reliable sources here report.

This represents a complete shift in policy, both as far as the government and as well as of the airlines, who have felt it too expensive an operation to attempt to compete on this route with foreign carriers.

► **Order DC-7s**—According to information reaching Airborne, Wenz Inc., Compania Mexicana de Aviacion, the country's largest carrier—618,000 pesos per year and 15 million miles flying annually—not only is willing to fly the weekly Mexico City-New York route but already has ordered three DC-7s, evidently for this purpose.

The Mexican government long has been unhappy to see waves of smaller countries with airlines flying into New York, while no Mexican line schedules flights there. It thus is willing to encourage the CMA project, if agreement on the route could be reached with the U. S. on an exchange basis.

That is now depends upon the present Civil Aeronautics Board consolidated hearings with American, Eastern and Pan American over this route. All three would very much like to fly Mexico-New York nonstop.

► **One U. S. Carrier**—However, the CAB hearings in Washington are far from concluded. The summer gave the airlines until Dec. 31 to file their consolidated briefs, and has recommendations to the full Board probably will be made some time this month.

It is heavily considered likely that CAB will authorize even then one U. S. carrier on the route in the amount of traffic (amounting probably in the neighborhood of 10,000 passengers per year) would hardly warrant it considering the load must be split to some extent with the Mexican line.

From the Mexico end, most logical of the three would be American which already flies the route through east nonstop and owns extensive foreign facilities in Mexico, including the Monterrey

August American also has several scheduled seats in banking traffic through advertising in the U. S.

► **The Other Side**—However, there is great pressure from the other U. S. carriers, each of which can offer a strong case. PanAm, of course, as a pioneer in Latin American service and presently flies from here to Houston where its New York passengers are transferred to Eastern.

Eastern has been after the Mexico route ever since the war. One of the principal Mexico City office branches is called the Eastern Airlines Building, although the line maintains only a ticket office and does not fly into Mexico.

One fact on this end that might influence the U. S. case is that the most likely Mexican line to get the local country rights (CMA) is a Pan American affiliate and reportedly 40% owned by PanAm. It would seem unlikely to have two PanAm lines competing against each other.

► **Are French's Problems**—The only other Mexican airline reported interested in the New York route is Aerolineas Gaste, a Mexican-founded line headed by Wenz Inc. and currently flying between Mexico City and Miami. However, this line is operating only DC-6s at the moment and hardly is equipped to take on the New York flight.

Another interesting aspect of the Mexico City-New York struggle is that Air France, the carrier now serving the New York to Mexico City route nonstop, has a commitment from Mexico which reportedly states that its Fifth Freedom rights cease upon the granting of the route to a Mexican airline. Nevertheless, CMA apparently would automatically eliminate Air France-New York traffic.

Local agent for Air France is Aerolineas Gaste, which is doing a booming business for the French and thus is in Air France's corner on the matter.

► **Challenger After**—Air France has not been into American on the route. Air France flight is scheduled for only 7 hr., while American takes 12 hr. for the same trip, at its most load at San Antonio, Dallas and often at Washington. It is estimated that 35% of AA's pas-

senger are usually New York bound and that once higher percentages of their service comes from through passengers.

U. S. carriers naturally are very unhappy to see a European carrier hauling the bulk of the New York-Mexico City traffic, while the two airlines concerned get only the minor part.

► **A Solution**—One solution to this rather tight and involved problem, with no action in sight from CAB before year-end, is that the airlines still want local agreements pass after the customer airline's line report and the government must go to the President, it is thought.

It is felt by airline experts here that a conditional agreement could be made at a relatively short time with the Mexican government by having the State Department request the local U. S. embassy in Mexico City to approach Mexico's Communications Department. The latter would see the possibility of a conditional agreement on the single New York-Mexico City route and, if the Mexican department is so inclined as reported, could reach a conditional agreement for carriers of the two countries to fly the route nonstop starting as soon as each country selected a carrier.

This would be a test agreement first; a permanent agreement could be reached between Mexico and the U. S., but such apparently is the case in eight years of discussion have not resulted in one. It apparently is better off than to sign a New York-Mexico City nonstop route agreement.

Noting of the U. S. carrier for the country route recently would depend upon the final Presidential decision, but the Mexican choice could be guaranteed to start nonstop flights at once.

Nonstop Temporality Halts Nonstop Service

North American Airlines is temporarily discontinuing its DC-6B nonstop outbound from nonstop flights (Aviation Week Dec. 27, p. 77).

Evolution flights indicate that these flights cannot be conducted under the existing 14-1, crew limitation, Harold Gage, director of operations, North American Airlines, says.

"The flights will be resumed shortly, either with multiple crews, or in accordance with the requirements of special regulation 603, presently under consideration by the Civil Aeronautics Board," Gage says.

Civil Reserve Air Fleet Quotas

Number of planes allocated to Civil Reserve Air Fleet, and referred to military reserve in an emergency, is increased from 368 to 517 under a revised plan announced by Defense Air Transportation Administration.

Because of the large increase in quantity and speed of transport, DDTA reports, the percentage of civil airlift required in the program has dropped from approximately 80% in 1952 to 1956 at present. Percentage of emergency airlift required has dropped from approximately 60% to 35%.

The 117 plane reserve—224 for defense and 93 for Pacific operations—includes 127 DC-4s, 187 DC-4s, 46 Constellation types, and 19 B-707 Stratojets. In addition, a contingent reserve, to provide for needed or other loss of planes in the reserve, is established. All aircraft will be controlled by the Military Air Transport Service.

Here is the allocation of the 517 planes:

Continental or other	DC-4s	DC-6	DC-4B	DC-4	B-707	Civil Reserve	Total	Percent of 517
Continental	1	1				2	79	15
American			25	18		43	149	29
Southwest				5		5	17	3
Capital		4				4	11	2
Colonial						1	79	15
Delta				7		7	11	2
Eastern		13				13	80	16
Flying Tiger		5				5	29	6
National			7			7	29	6
Northeast		1				1	13	3
Pacific Northern						2	11	2
Panama		5	3			8	34	7
Pan American					16	16	82	16
Seaboard						7	11	2
Shen		2				2	27	5
Shen							40	8
Trans World							18	4
United		20	13	10		43	94	18
Western			5			5	29	6
World		15	161	59	32	19	260	50
Non-optional							4	1
Oil Eastern		4				4	11	2
North American				1		1	79	15
Seaboard & West							5	1
Shen							5	1
Trans World							5	1
United							5	1
World							5	1
Total		26		4		30	27	5
Grand Total	15	127	59	33	19	66	317	61

TWA Completes Plan For Long-Term Credit

With its re-organization program in high gear and prospects of Lockheed takeover Super Constellation on the horizon, Trans World Airlines has now placed a long-term financing program with Equitable Life Assurance Society.

In addition, the company has re-negotiated credit with a group of major U. S. banks headed by the Irving Trust Company of New York.

Debt Revisited—This renews TWA's debt considerably from \$23.7 million at year-end. The same reduced its debt to that figure from a total of \$41.8 million at the end of 1953.

In obtaining a \$36-million debenture debt over Equitable in 1950, the

total commitment to that company was increased to \$40 million, secured by a 15-year general mortgage due in 1968. Of that, \$15 million is actually subordinated.

The remaining \$25 million will be used during the delivery period of TWA's 39 J49-52 Super Constellation, February through June.

Revisiting Credit—As a result of this re-negotiated financing by Equitable, the airline has cancelled out a bank credit of five-year maturity for \$25 million, partly re-negotiated for financing the 23 Constellation.

In connection with the stock sale agreement with Irving Trust and other participating banks, TWA paid off \$31.1 million of bank credits due solely to May of next year. A revolving credit line was re-negotiated in the amount of \$18 mil-

lion, running to June 1957. Of that, \$1 million was borrowed last month.

Other participating banks are for the monthly credit include: Bank of America, National Trust Savings Assn., Mellon National Bank & Trust Co., Bankers Trust of America, Security First National Bank of Los Angeles and California Bank.

National Airport Has Biggest Traffic Year

Washington National Airport had its biggest year in 1954, with total number of passengers handled increasing almost 15% over 1953 to hit the 5.1 million mark.

Despite the larger equipment introduced by most airlines, aircraft operations at the airport which were up over the previous year, showing an increase of 3.2%. An estimated total of 261,000 takeoffs and landings were made.

Increasing Loading Capacity—The terminal was continually loaded with passengers during the year of having more aircraft on hand during peak hours than there were parking spaces for them and extending, in an effort to ease the congestion, construction has been started on a freight which will extend out from our present gate position to provide for additional loading stations.

From an economic standpoint, the airport finished in the black for fiscal year 1954, totaling in \$1.9 million as compared with a congressional appropriation of \$1.3 million for its operation during the year. The airport did not receive its receipts. All income is turned over to the general fund of the U. S. Treasury and operating expenses for the following year are supplied in the form of congressional appropriations.

Seaboard Forecasts Atlantic Gains in '55

Despite persistent reports that Seaboard & Western Airlines' chances for a trans-Atlantic all-stage certificate are dimmer than ever, the carrier looks forward to a big year in 1955.

Arthur V. Nondak, executive vice president of the all-freight carrier, reports that commercial cargo raised about the airline by Seaboard during 1954 shows an increase in ton-miles of more than 100% over 1953. "Our economic forecasts for this year indicate that this case will come up in representative figures," he says.

OSAP & Foreign—Air Force announcement of a new air logistics program, Nondak says that alone should account for a big jump in business. "In addition, the program by the Air Force in connection with the Department of Defense is expected to be one of the most significant in the amount of \$18 mil-

lion, running to June 1957. Of that, \$1 million was borrowed last month.

Other participating banks are for the monthly credit include: Bank of America, National Trust Savings Assn., Mellon National Bank & Trust Co., Bankers Trust of America, Security First National Bank of Los Angeles and California Bank.

Western Omelet

• CAB counsel proposes to expand service in West.

• Plan shifts trunk stops, hars nonstop coach bid.

Airline service in the West will be expanded considerably if a pattern set by a Civil Aeronautics Board counsel is adopted by the Board. The proposed service is outlined in a brief filed by counsel for the Bureau of Air Operations with Executive F. D. Mason as the Denver service area.

Under terms of the plan, Trans World Airlines and Western Air Lines would serve into Denver, which has been United Air Lines' "pivot" location for as transcontinental service is expanded. United would move into Kansas City, now served by TWA.

Airlines would be allowed to expand its nonstop west coast service.

Re-organization—TWA would serve Denver on its transcontinental route, except that flights leaving Denver couldn't serve Kansas City or St. Louis and flights to or from the West couldn't have to stop at terminals in San Francisco, leaving Los Angeles intermediate.

United would serve Kansas City, except on flights serving Denver or Chicago.

American's Routes 7 and 25 would be extended from Chicago to Los Angeles and San Francisco. That would allow American to offer meeting and stopover service from each other out of Chicago at Detroit, Indianapolis and Buffalo to the West Coast.

Western would get a new route serving between Chicago-San Francisco and Denver, via Reno and Salt Lake City. The authorization for Reno would be for a term of three years, and certain notations would be placed on service to points north and east of Salt Lake City, other than Denver.

Passenger Benefits—American would not. "Competitive service allows the passenger the opportunity to serve various benefits in service. It can be extended with the maximum advantage effect on competitive service routes."

The Board believes that the traffic on the major segments of the route is not sufficiently dense to warrant extending the rate of competition. The proposed plan is designed to extend competition believed to be in the public interest without economic disruption of the air transportation system and at the same time to furnish a substantial amount of new and improved service.

Applications for route expansion to the East and West by Continental Airlines would not be granted by Bureau counsel, but Continental's present service from Denver to Kansas City, and Denver to Los Angeles through a direct Airways interchange, would be protected by nonstop service duplication of these routes by United and TWA.

Needless Plan Rejected—The North American Airlines group wants to offer coach service Chicago-Kansas City.

Denver-Los Angeles-San Francisco on the grounds that there is enough traffic on other routes wouldn't be lost and that the service would be more efficient at developing coach traffic.

Counsel advises turning the North American application down, finding that service would be adequate under the proposed plan. Further, the brief observed that the airline's focus has been questioned in the unserved North American corridor present law.

In making the factors involved in the case, it is found that it is not largely associated with new competitive service in an area which has shown substantial growth in recent years. Three major points involved—Denver, Kansas City and Salt Lake City—have had no competitive transcontinental service.

Requirements Intended—No proof of adequate service was found in the case of the service involved in the proposed plan in relation to their present obligation.

It is pointed out that despite requirements for economical route operation



Boeing 707 Climbs to New Heights

Boeing 707 jet transport prototype has soared "unbelievably higher and at greater speeds" than the 42,000 ft. and 580 mph, previously achieved. Boeing Airplane Co., Seattle, Wash., says—without giving exact figures. The company reports the 707 now has been in higher altitudes than any other transport in history. It has actually completed the second part of its test program and logged 95 hr. 34 min.

Eight feet with its cabin pressurized for 10 of but two hours. Its F4W J-43 engine pit has been disassembled, for permanent inspection, with the engine remaining on those test engines. No parts replacement was necessary. Boeing states. While the 10,000-ft. runway was closed at Boeing Field, its report recently, the 707 used a parallel 5,000-ft. runway and took off in less than half the available space.

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lagging growth of visual service.

Transcontinental voyaging flights are
found to have a marked effect on visual
service reliability, either because they can
operate off through traffic and cause a
reduction of service to intermediate
points.

► **One-Center Approach**—Use of newer,
larger aircraft and the introduction of
high-density coaches also have traffic
density requirements, since it takes
more passengers to make them pay.
The expansion of one-center service
from the switched access is pointed to
as an improvement in service and a po-
tential generator of new traffic. One-
center service is more attractive to the
passenger because his baggage and
ticket arrangements are handled by a
single company, and connections are
usually easier to make.

**New Canadian Rule:
One Mile From Clouds**

Canada's Dept. of Transport has
ruled that planes flying under the
VFR (visual flight rules) must now
remain clear of clouds, instead of 2,000

ft. as was required previously. Visi-
bility requirements were of the 1000
feet minimum, increased from one mile
to two miles.

The new rules, under consideration
for some time, were tried out experi-
mentally last in October for civil and
military aircraft. The new regulations
also require that planes flying under
visual flight rules above 3,000 ft. pro-
ceed along normal routes and regu-
lated altitudes. These new regulations
must be in harmony between laws and
as an angle of at least 45 deg.

**Patterson Supports
Railroad Subsidies**

Los Angeles-United Air Lines pres-
ident W. A. Patterson recommends that
subsidies be continued if necessary to
see them through their economic dif-
ficulties.

"If airlines would nobody to see
them through a period of making air-
passenger to new markets, they should
have nobody and we will support it."

► **Turns the Tables**—Patterson then
turns the tables on the railroads which
have been complaining about airline
subsidies. In fact, he says the airlines
are in good economic health and re-
quire little subsidy.

"I don't intend to get into any con-
troversy, but the railroads started 11 or
12 years ago complaining about the
airlines and their subsidies," Patterson
says. "It's an old record and it's getting
a little tiring."

He points out that only 8% of to-
day's airline passengers fly on subsidized
routes.

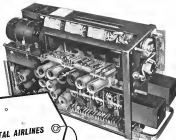
"It can be said that these costs exist
solely in a relatively new and very
small portion of the air transport in-
dustry, namely, the local service
lines, which have been established by
the Civil Aeronautics Board during re-
cent years to serve communities so
small that the existing traffic does not
justify economically self-sufficient op-
erations," the UAL president says.

"However, 95% of all aircraft is served
without subsidy."

► **Annual Revenue**—He told a Town
Hall meeting here last week that UAL
and other major airlines receive 45
cents per ton-mile for carrying mail
whereas the average to the Post Office
buses postage on the mail amounts to
\$1.50 per ton-mile.

"It is true that we have taken away
a substantial part of the railroad busi-
ness," Patterson says. But he suggests
that railroads strengthen and restore
their investment position in the trans-
portation of freight, which he said al-
ways has been their principal source of
revenue. "There is nothing on the scene
today or visible in the engineering
future of air transport to indicate the

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airmen will ever become a serious competitor of the male in the field of flight," he said.

►Flight Advantage—Puthmann believes there is no question that airlines have a problem, but he says their advantages in the flight field can restore their economic health.

"You can pull a lot cheaper than you can lift. We lift for each per ton mile; they pull for each per ton mile."

Puthmann's speech at Texas Tech followed last night's flight of American Airlines president C. R. Smith's "How to Run a Railroad" speech (American Week, Dec. 23, 1974, p. 15), which was also delivered here in Los Angeles.

Dallas Wins Support In Airport Squabble

Another chapter in the Ft. Worth-Dallas airport squabble unfolded last week.

Failure of Civil Aeronautics Board to give notice to and permit Dallas to be heard prior to rendering a decision to the Central Airlines removal proceeding was a violation of the due process clause of the federal Constitution, says the National Institute of Municipal Law Officers in a brief filed with the U. S. Supreme Court.

The argument, which is composed of over 700 municipal corporations, filed the brief supporting the Dallas petition as a friend of the court. NIMLO is not a party to the case, but it intervened in the outcome. Such briefs are permitted in order to assist the court in making its decision.

►The Ft. Worth-Dallas controversy in the case, CAB had stipulated that Central Airlines was protected for service between Oklahoma City, Kansas international ports and the terminal point Dallas-Ft. Worth-to be served through Ft. Worth International Airport.

In this case, says NIMLO, CAB departs from this established policy in that "it prohibits the use of one of the most active civil airports in the country for the reasons of traffic congestion and operating efficiency, both matters of judgment peculiarly within the competence of officials of the airline and respectively concerned."

►New Policy—Today's brief to the court, NIMLO says, "It thus represents a new policy and attitude of the Board, and if it is put into practice without notice and hearing, as claimed by the city of Dallas, it has profound consequences to the growing number of air carriers which have more than one airport within a distance which the Board may decide is 'adequate or convenient.'"

"These consequences are noticed to

know," the brief continues, "when and how the policies of the federal government affect their interests. They are entitled to a fair opportunity to contest these policies, as actual or potential conflict with local interests exists."

Each of the important contents is consistently involved in the continuing parade of route certification proceedings before CAB. His stipulations are not exposed and limited to remain constantly there past spent federal resolutions of these problems is consistently restoring legal proceedings.

Puthmann, it is not in the public interest that they be subjected to such expense and uncertainty, merely because CAB has deliberately and unduly and seriously failed to give notice to the public of fundamental changes in policy and of the scope of legal proceedings to which they affect local interests."

►Four Proceedings—NIMLO says the extent of this burden is fully indicated by the current involvement of Dallas in four route certification proceedings in which the use of Love Field has been so much involved.

"The prospect of litigation before the Board, or before the courts, if necessary, in a continuing process of maintaining a local veto in local efforts in perpetually expediting to the large and growing number of communities dependent on civil air transportation," the brief adds.

In conclusion, NIMLO asked the court to order CAB to grant the city an opportunity to be heard in this case. "Only in this way can the important issue involved be decided fairly, giving a second, and in keeping with the due process of law required by the federal Constitution."

SHORTLINES

►British Overseas Airways Corp. shows an unofficial New York-Norfolk speed record of 1 hr. 15 min. made on a scheduled flight by a BOAC Starliner.

►KLM Royal Dutch Airlines has added Sao Paulo, Brazil, to its South America service. Sao Paulo will be served weekly on KLM's Amsterdam-Sao Paulo-Buenos Aires route.

►Midwest Airlines plans to build a new passenger terminal at Conard University Airport in Ithaca, N. Y. The new building, which is scheduled for April completion, will provide expanded passenger-handling facilities and will also add office space within the past office-terminal building.



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support of troops. It also can be fitted as a combat troop carrier or an ambulance plane. The YC-130 can operate from shorter runways with greater rate of climb than either reciprocating or Turbo-Jet engine aircraft.

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